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Elementary Textile Microscopy

Definition of a Microscope—Uses—Types—Compound Microscopes—Parts of the Compound Microscope—The Stand—Illuminating Apparatus—Focussing Devices—The Microscope Proper—Objectives—Oculars

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(Microscopy is playing an increasingly important part in the work of the textile chemist and is one of the most valuable agencies in the field of Textile Research. This article is the first of a series which will cover the subject of textile Microscopy in such a way as to be a valuable aid to the student, and to the Textile Chemist who is not too far advanced in this type of work. This subject will be considered under the following divisions:

I, Apparatus; II, Methods; III, Identifications; IV, Low Power Microscopy; V, Photomicroscopy. *L. A. O.*

A MICROSCOPE is any optical instrument which gives an enlarged image of a near object. It makes it possible for the eye to see more clearly those objects which are normally indistinct and it also makes it possible for the eye to distinguish and separate objects which are normally invisible.

Uses of the Microscope

The microscope shows only characteristics which would be visible to the eye alone if the object were larger; these characteristics include such properties as size, shape, color, relative position, solubility or insolubility, structure or markings, behavior on treatment with chemicals or energy, and other physical properties. Specifically applied to textile work, the microscope shows such things as the identification of fibers, identification of starches, identification of special finishes, presence of foreign matter, penetration of dye or starch, number of filaments in rayon, surface characteristics, weave or spinning defects, injury by mechanical or chemical means.

Types of Microscopes

Microscopes in general may be divided into two classes —simple and compound.

The simple microscopes vary in appearance and use, but all of them consist of esssentially the same optical equipment: one lens or lens unit, usually a double convex lens, in a holder of some sort. Examples of simple microscopes are pick glasses, reading glasses, watch maker's glasses, pocket magnifiers, dissection microscopes, needle threaders, thermometer readers.

The compound microscope (to which the simple word microscope is usually applied) consists of two lens units acting jointly and in succession. The unit near the object (called the objective) forms an enlarged inverted image of the object, which is then enlarged but not inverted by the unit near the eye (called the ocular or eyepiece), hence the final image is much enlarged but is also inverted.

Types of Compound Microscopes

The compound microscope may be obtained in any one of many forms, but in general is either of the binocular or of the single tube form.

The binocular microscope, in its usual form, has two oculars and two objectives, each set carefully selected to match (paired). The advantages of this type are that both eyes may be used, thus cutting down eyestrain; and that a stereoscopic or three-dimensional effect is obtained. The disadvantage is that this type of microscope cannot be obtained in very high powers of magnification. Another type of binocular microscope, usually referred to as the mono-objective binocular microscope has one objective and paired oculars. This microscope permits the use of both eyes, and may be obtained in high powers. The stereoscopic effect, while not as good as in the bi-objective type is better than in the ordinary form.

The single tube, or ordinary form of microscope, has one objective and one ocular in use at a time. Obviously this type would be less expensive than either type of binocular microscope; the stereoscopic effect is not present, however, and the eyestrain is greater. This type of

microscope is often given a special name when fitted with auxiliary apparatus for special purposes, thus, the chemical microscope, the petrographical microscope, the ultramicroscope, the fluorescence microscope and the metallurgical microscope are all special forms of the general type. When there is no special use for a microscope, it is given a letter or number by the manufacturer.

Parts of the Compound Microscope

The parts of a microscope may all be included under four general heads—the stand, whose function is to support the whole of the microscope and the object to be studied firmly and steadily; the illuminating apparatus, to light the object so that it may be seen, and to bring out any special characteristics of the object; the focussing apparatus, to bring the lens units the correct distance from the object so that the image is sharp and clear; and the microscope proper, the purpose of which is to produce a clear enlarged image of the object.

The Stand

The stand is made of the following parts:

The base is the lower part of the microscope upon which the whole thing rests. In this country, the shape of the

Figure 1. Pocket Magnifier.

base is usually that of a horseshoe, this form being somewhat more convenient for the addition of auxiliary substage apparatus than the tripod form which prevails in Europe and which is steadier than the horseshoe type.

Directly above the base is a short upright called the pillar in which is located the inclination joint, which permits the microscope to be used in the tilted position, for greater comfort of the operator, or in the horizontal position, for photomicroscopic work.

Figure 2. Dissecting Microscope.

At the top of the pillar is the stage, a flat platform with a hole in the center, which serves to hold the object or the glass slide upon which the object is mounted. The stage usually has two spring clips to hold the slide in position, but these clips are not necessary unless the microscope is tilted. The stage is usually square or rectangular in shape, but may sometimes be circular and capable of being revolved, in which case angles may be measured.

Above the stage, and in line with the pillar, is the arm of the microscope which contains the focussing devices and supports the microscope proper. The arm is also used as a handle for lifting, transporting, or moving the microscope.

Illuminating Apparatus

Microscopes often come (and especially of late years) with condenser attached, but since this is a refinement and not a necessity, it will be dealt with elsewhere. The illuminating apparatus ordinarily present on a microscope consists of a mirror and a diaphragm. The mirror is mounted on a fork at the end of a swinging arm, pivoted below the stage so that it is adjustable to any angle. One side contains a plane mirror, giving parallel rays and the other side contains a concave mirror capable of focussing a strong light on a small area. The diaphragm, placed under the stage, may be one of two types: the disk form consists of a circular disk with various sized openings on it, so pivoted that the openings come under the hole in the center of the stage; the iris diaphragm is of the type usually found in cameras, it consists of a number of

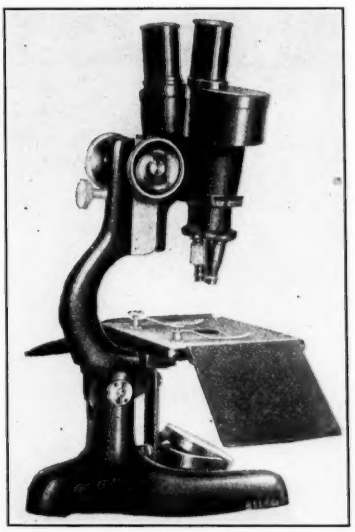

Figure 3. Binocular Microscope.

leaves, which by a lever movement move inward or outward from the center of the opening. Both types regulate the amount of light passing up through the stage opening, and hence the amount of light passing through the microscope and into the eye. The iris type gives better and more delicate control but is more easily injured. The diaphragm should be so regulated, in use, that no more light enters the microscope than is necessary; this prevents eyestrain and fatigue, as well as sometimes rendering the object more visible.

Focussing Devices

The purpose of the focussing apparatus is to so adjust the distance between the objective and the object that the image formed will be sharp and clear. The preliminary rough focussing is done by means of the coarse adjustment—a pinion gear, turned by wheels projecting from the side of the microscope arm, engaging with a rack on the microscope proper. The final, delicate adjustment

is made by means of the fine adjustment, which actuates a somewhat complex lever system which may lift the microscope proper on the arm or which may lift the arm itself on the pillar. The fine adjustment is often graduated so that vertical distances may be measured by focussing on the top and bottom of an object and taking the difference in the readings. The coarse adjustment rack and its guides should occasionally be rubbed with a drop or two of oil and then wiped dry, but *the fine adjustment*

Figure 4. Binocular Microscope.

should never be tampered with—if anything happens to it, the microscope should be shipped back to the manufacturer for repairs.

The Microscope Proper

The large outside tube of the microscope proper is called the body tube. Manufacturers have standardized on 35 millimeters as the diameter of the body tube but microscopes of 50 millimeters diameter are made and are preferable for photomicrographic work. Inside the body tube is a felt, through which usually passes an inner tube which may be raised or lowered and which is called the draw tube. The outside of the draw tube has graduations so that it may be set for any distance between the objective and the ocular, the standard tube length being 160 mm. Increasing the tube length increases the magnification but causes some distortion and should be avoided unless necessary to correct for abnormally thick or thin cover glass as may be seen later. Some microscopes are made with a fixed tube length of 160 millimeters.

On the bottom of the body tube is located, usually, a nosepiece—a device for rapidly changing objectives, this has the further advantage of protecting the back lens of the objective from dust or dirt. The simplest form of nosepiece consists of a number of arms, each having an opening for an objective and when an objective is in place, all are covered at the top by the rigid part of the nosepiece, but while being moved are open to the air. The more modern types consist of a complete, movable disk, rotating under another fixed disk so that the back of the objective is always closed to the air and dust.

The objectives and oculars, which are parts of the microscope proper, are so important that they will be discussed separately.

Objectives

Objectives classified according to use are: microscopic and photomicroscopic. Photomicroscopic lenses differ from microscopic lenses in that flatness of the image is desired above true color rendering, also by having, generally, a diaphragm built into the lens somewhat similar to a camera lens.

According to the medium used between the objective and the object, objectives are classified as dry (air only present), water immersion, and oil immersion.

According to the correctness in rendering of the image as to flatness and color, objectives are classified as aplanatic, apochromatic, semi-apochromatic and achromatic. To understand the meaning of these terms, it is necessary to discuss common structural faults found in lenses.

When light passes through an ordinary lens, the rays entering the edges of the lens are bent more than the rays entering the central portion of the lens and hence come to a focus at a point nearer to the lens than the true focus. This phenomenon is called spherical aberration. Spherical aberration may be reduced by using a diaphragm to cut off the rays entering the edges of the lens or it may be corrected by altering the shape of the lens during construc-

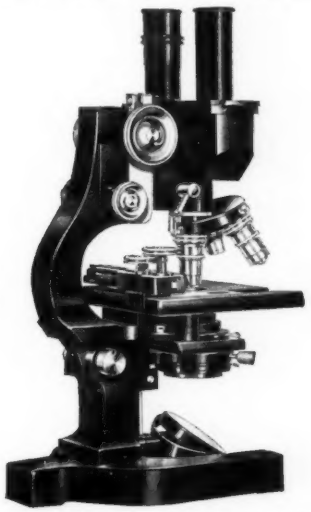

Figure 5. Binocular Mono-Objective Microscope.

tion. A lens so corrected for spherical aberration is called an aplanatic lens.

Ordinary daylight is made up of light of varying wave lengths all of which are refracted varying amounts by a lens. When daylight enters an ordinary lens, the violet rays come to a focus before the red rays, this is called chromatic aberration and can be corrected only by combining lenses of opposite effects. In the case above, a lens which would bring the red rays to a focus first would be used in conjunction with the lens mentioned. The terms apochromatic and achromatic refer to the amount of correction of chromatic aberration. An apochromatic objective has a chromatic correction for three colors and a

spherical correction for two colors; it is made of fluorite and borate or phosphate glass and should always be used with a compensating ocular. An achromatic objective has chromatic correction for two colors but the spherical correction is confined to one color—the yellow-green portion of the spectrum which comprises the largest part of daylight. A semi-apochromatic objective was formerly an improved achromatic objective and midway in properties between an achromatic and an apochromatic objective, but

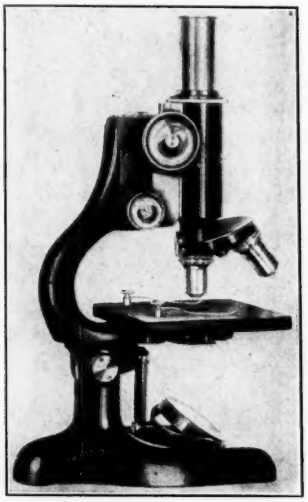

Figure 6. Single Tube Microscope.

of late the achromatic objectives have been improved so much that achromatic and semi-apochromatic objectives are practically the same.

The equivalent focal length of an objective is the focal length the total objective combination would have if considered as a single lens.

The working distance of an objective is the distance between the front of the objective and the object when the object is in focus. Working distance decreases with increasing magnification.

Magnification is expressed in "diameters," that is, the number of linear times the image is larger than the object. Total magnification, with a tube length of 160 mm., is equal to the product of the magnification of the objective and the ocular. When the tube length is greater than 160 mm., the magnification is proportionally increased.

The diameter of the field is the true diameter of the circular field as seen through the microscope; the diameter of the field decreases with increasing magnification.

The depth of focus of an objective is the vertical distance through which an object is plainly visible.

Two objectives are said to be par-focal when they may

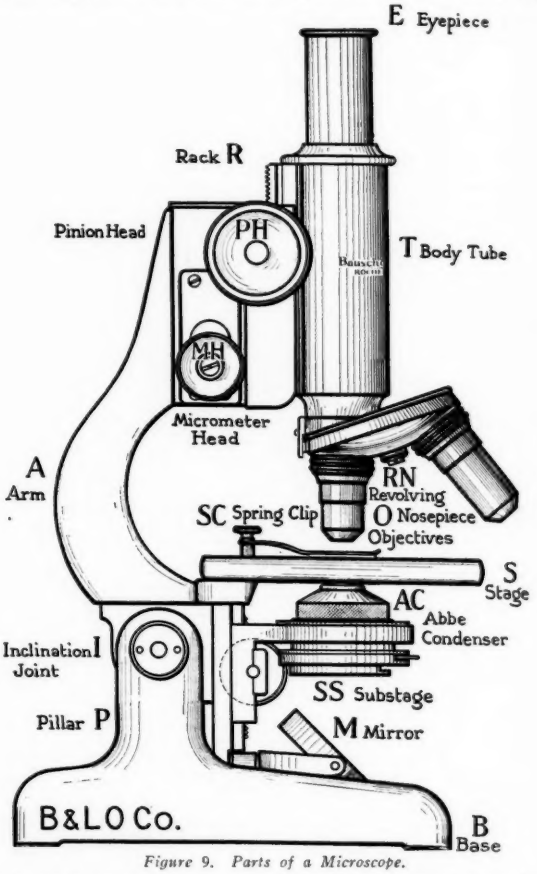

Figure 9. Parts of a Microscope.

be interchanged without changing the focus of the microscope except within a slight adjustment of the fine adjustment.

When an objective is focused on a minute object, the angle between lines drawn from that point to the ends of a diameter of the front lens of the objective is called the angular aperture. If the sine of half this angle is multiplied by the index of refraction of the medium between the objective and the object, the product is found to be related to various properties of the objective. This product is called the numerical aperture (N.A.) and may be defined by either of the following equations:

$$N.A. = n \sin \tfrac{1}{2} a$$

or

$$N.A. = \frac{d}{2f}$$

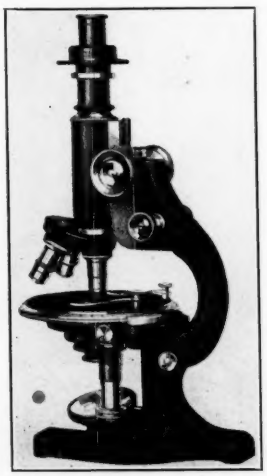

Figure 7. Chemical Microscope.

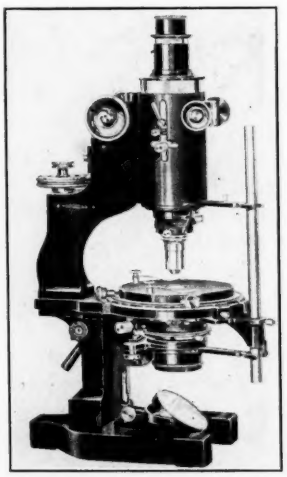

Figure 8. Petrographical Microscope.

where N. A. = numerical aperture
n = index of refraction of medium between objective and object
a = angular aperture
d = effective aperture of the back lens of the objective
f = equivalent focal length of the objective

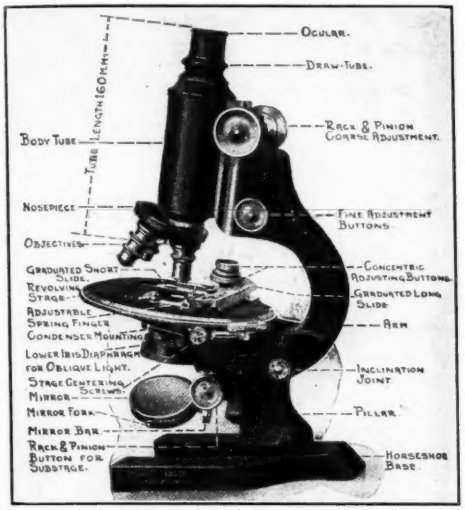

Figure 10. Parts of a More Completely Equipped Microscope.

The resolving power (the smallest space between parallel lines distinguishable by a lens) is proportional to the numerical aperture.

The brightness of the image is proportional to the square of the numerical aperture.

The depth of focus, flatness of field, and working distance are inversely proportional to the numerical aperture.

Since N. A. = n sin ½ a, it may be seen that the N. A. may be increased by increasing a (using a lens of small working distance) or by increasing n.

If a dry objective is used, only air is present below the objective and n = 1.00, if the space is filled with water, n = 1.33 and if cedar oil is used, n= 1.52. In the first case, we have a dry objective; in the second, a water immersion lens, and in the third, an oil immersion or

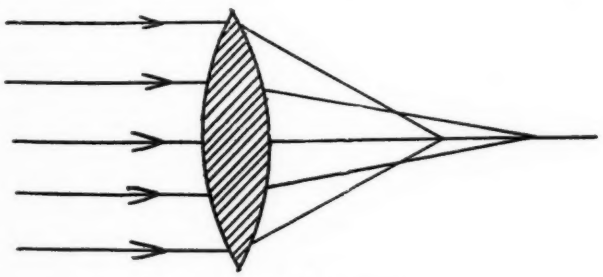

Figure 11. Spherical Aberration.

homogeneous immersion lens (so called because the index of refraction of the oil is about the same as that of most glasses.)

Immersion contact causes a greater fraction of the light passing through an object to enter the objective and thus increases the brightness of the image.

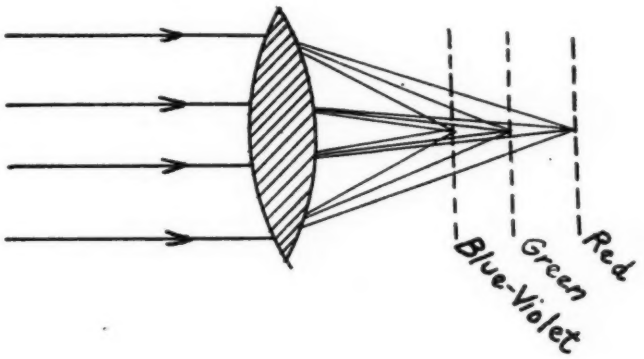

Figure 12. Chromatic Aberration.

Immersion contact is used for objectives of a magnification greater than 43 x (power) and is also used between the condenser and the slide, with condensers and dark-ground illuminators for special purposes.

The constants of various objectives are given in Table I.

TABLE I

PROPERTIES OF OBJECTIVES—BAUSCH AND LOMB

Effective Focus—Millimeters	Magnification—Diameters	Numerical Aperture	Working—Distance Millimeters	Micrometer Value—10 x oc.
		ACHROMATIC		
48	2	0.08	53.0	81.0
40	2.6	0.08	43.5	56.0
32	4	0.10	38.0	41.0
16	10	0.25	7.0	16.4
8	21	0.50	1.6	7.9
4L	43	0.65	0.6	3.8
4L	45	0.85	0.3	3.7
3	60	0.85	0.2	2.8
*1.9	97	1.25	0.15	1.7
		FLUORITE		
4	43	0.85	0.34	3.8
1.8	100	0.80	0.35	1.7
*1.8	100	1.30	0.13	1.7
		APOCHROMATIC		
16	10	0.30	4.80	
8	20	0.65	0.60	
**4	45	0.95	0.18	
**3	62	0.95	0.14	
*3	61	1.40	0.12	
*2	90	1.30	0.12	

* Oil immersion objective.

** Adjustable for cover-glass thickness by means of a graduated collar.

OCULARS

Oculars, like objectives, may be classified by the correction which they give. The ordinary, or Huyghenian ocular, is used with achromatic objectives and has about the same correction. The compensating ocular is devised to magnify most the color magnified least by an apochromatic objective, with which it is always used; in this way,

color fringes around an image are eliminated and a clear sharp focus is obtained. The hyperplane ocular is midway between the Huyghenian and the compensating oculars, giving a much flatter image than the former; for this reason, it is often used with aplanatic objectives.

Classified by construction, we have the Huyghenian and the Ramsden oculars. The Huyghenian ocular is made up of two plano-convex lenses with the convex sides downward on both lenses and the diaphragm between. The Ramsden ocular also consists of two plano-convex lenses but has the convex side of the bottom lens turned upward; it is used practically entirely for filar micrometers.

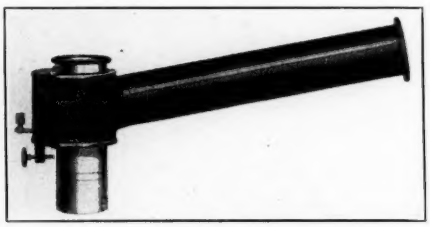

Figure 13. Demonstration Ocular.

The demonstration ocular is an ocular containing a prism and an additional horizontal ocular, so that two persons may look at the same object at once. It is used only for purposes of instruction.

The comparison ocular has a long arm containing a prism at each end and a prism system and ocular in the center. The end prisms are each placed over an already focused microscope and both fields are seen simultaneously in the central ocular. This ocular is very useful in comparing materials differing only slightly in appearance because, in this way, minute differences need not be carried in the head but may be directly observed.

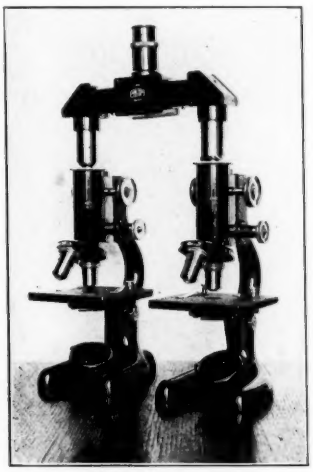

Figure 14. Comparison Ocular and Two Microscopes.

Modern oculars are always marked with the magnification (5 x, 7.5 x, 6.4 x, 10 x, 12.5 x, 20 x, etc.), but the older oculars were marked with the equivalent focal length; thus a 2" ocular magnifies 5 x; a 1", 10 x; and a 1/2", 20 x. A magnification of 20 x is the highest practicable magnification for an ocular, as above this the distortion of the image is too great for good practice.

(To be continued)

Plan United Organization For Textile Research

Meeting to Be Held in New York May 23

A MEETING of representatives of several textile associations, all of whom are interested in the general subject of textile research, was held at the University Club in Boston, on Wednesday, April 30. The meeting was addressed by various leading figures in the textile world, all of whom stressed the need existing in America for co-operative textile research, and voiced the belief that the time was ripe for the creation of some central bureau to prosecute both pure and applied textile research on a nation-wide scale. Although no definite promises were made, the opinion was expressed by various speakers, that if a thoroughly representative, impartial body should be formed which would obviously be representative of the entire textile industry of the country, textile corporations generally would be willing to subscribe to the support of its research program.

After luncheon Franklin W. Hobbs, President of Arlington Mills, acting as toastmaster, introduced Dr. Elvin H. Killheffer, President of the American Association of Textile Chemists and Colorists, who, after reviewing the need for co-operative textile research and the obvious desirability of all factors in the industry making common cause for the prosecution of such research, offered the following resolution, which was unanimously adopted:

"Whereas, this is a meeting of all interested associations and bodies having as an object the establishment of some centralized American Institute for Textile Research, therefore, be it

"Resolved, that it is the sense of this meeting that the following bodies, or associations, be each invited to elect, or appoint, one person as a member of a preliminary board of directors of a centralized American Institute for Textile Research: (See appended list.)

"Be it further Resolved that, for the purpose of sending this resolution and accompanying invitation to the various bodies and associations, an invitation committee be hereby created to consist of two members each from the American Association of Textile Chemists and Colorists and the Textile Research Council, and be it further

"Resolved that the meeting of the preliminary board of directors be for the purpose of considering and adopting some definite plan of organization."

After the adoption of this Resolution a joint committee, as provided for therein, was appointed by the respective presidents of the two associations as follows: Messrs. P. J. Wood, Chairman, and Dr. W. M. Scott, representing American Association of Textile Chemists and Colorists, and C. H. Clark, Secretary, and Dr. W. F. Edwards representing Textile Research Council.

This committee immediately met and in accordance with the directions of the meeting, prepared a list of associations, government bureaus and textile schools to be invited to send delegates to an organization meeting to be held at the Chemists' Club, New York City, at 1:30 P. M. on Friday, May 23.

The obvious spirit of cordiality and enthusiasm which marked the Boston meeting augers well for the success of the enterprise.

Those to whom invitations to participate in the organization meeting were addressed, are as follows:

American Cotton Manufacturers Association.
American Association of Textile Chemists and Colorists.
Associated Knit Underwear Manufacturers Association.
Cotton-Textile Institute.
Institute of Carpet Manufacturers of America, Inc.
National Association of Cotton Manufacturers.
National Association of Finishers of Cotton Fabrics.
National Association of Hosiery and Underwear Manufacturers.
National Knitted Outerwear Association.
National Association of Wool Manufacturers.
Silk Association of America.
Southern Textile Association.
Rayon and Synthetic Yarn Association.
Textile Research Council.
Wool Institute.
American Lace Manufacturers Association.
Silk Dyers Association of America.
Association of Cotton Textile Merchants of New York.
Converters Association.
National Association of Shirt Manufacturers.
Wholesale Dry Goods Institute.
National Retail Dry Goods Association.
Textile Section, American Society of Mechanical Engineers.
Committee D-13, American Society for Testing Materials.
Silk Dyers and Printers Association.
Laundryowners National Association of United States and Canada.
National Association of Dyers and Cleaners of U. S. and Canada.
Better Fabrics League of America.
American Home Economics Association.

U. S. Government Departments and Bureaus

Department of Commerce:
Textile Division, Bureau Foreign and Domestic Commerce.
Bureau of Standards.
Department of Agriculture:
Bureau of Agricultural Economics.
Bureau of Plant Industry.
Bureau of Animal Industry.
Bureau of Chemistry and Soils.

Textile Schools

A. French Textile School, Georgia School of Technology, Atlanta, Ga.
Bradford-Durfee Textile School, Fall River, Mass.
Textile Dept., Clemson Agricultural College, Clemson College, S. C.
Lowell Textile Institute, Lowell, Mass.
New Bedford Textile School, New Bedford, Mass.
North Carolina Textile School, Raleigh, N. C.
Philadelphia Textile School, Philadelphia, Pa.

U. S. Obsolescence Studies Start with Textiles

By Waldon Fawcett

THE Division of Industrial Machinery, U. S. Department of Commerce, crusader for proper recognition of obsolescence, has just gone to a foreign source for its prize example of the perils that lurk in incomplete accounting. This object lesson concerns the dyestuffs and textile industries of Japan which, as our readers may know, have developed in recent years to a point where their products have virtually driven from the Chinese market certain classes of British and American goods.

Set over against this surface picture of singular success in capturing a competitive market is the information which has just reached this country to the effect that the Japanese manufacturers do not charge off regularly and systematically for machinery obsolescence. According to the story, in one exceptional year, when the mills returned a profit better than 30 per cent, the management charged off for obsolescence a bare 15 per cent, which is not more than the progressive American manufacturer might write off in a normal year for machinery operated twenty hours a day. But, by and large, there is no sustained habitual reckoning with obsolescence and the prediction is made that the Japanese industry may awake one day to find that capital investment has vanished in what the Federal specialists characterize as "progressive obsolescence."

It is not alone overseas, but likewise in the United States, that the dyeing and textile industries are counted upon to supply the alarmist of the Commerce organization with graphic illustrations of unconscious superannuation of factory equipment. So much is being done by the current studies of machinery in the knitted outerwear factories in the Philadelphia and Cleveland districts. The returns from the survey of 1,100 machines in thirty odd factories in the Philadelphia territory indicate unrecognized obsolescence averaging more than 25 per cent. Enough has been learned in this cross-sectional analysis

of a representative section of the industry to fortify Federal officials in their belief that the secret of the ills of supposed over-capacity in American industry lies in the unnecessarily high levels of production costs made necessary by the continued use of outdated equipment.

That investigative action has succeeded preachment, with respect to machinery obsolescence, is due to an arousal of curiosity on the part of machine users and machine builders in various fields. For as much as five years past Chief W. H. Rastall of the Division of Industrial Machinery has conducted, all but single-handed, a movement to arouse the forces of American industry to the dangers of obsolescence. The primary objective was, to be sure, the development of an actuarial system which would discount the consequences of "catastrophic obsolescence"—the overnight relegation of the entire machinery installation of a factory due to a sudden jump in invention, or an upset in apparel fashions. But, indirectly, the ambition was to evoke in industry a consistent and habitual allowance for the consequences of obsolescence as distinguished from plant depreciation.

Slow progress was made in this sentimental drive until opportunity opened, a short time since, to pursue the obsolescence element into the realm of what are known as Industrial Market Studies. For some time past the Division of Domestic Commerce has been lending itself to a unique form of co-operation with trade associations for industrial market research. The Division has not the funds for specialized research of this kind wholly on its own account. But, groups of manufacturers, imbued with enthusiasm by what has been accomplished by that species of co-operation which details Research Associates at the U. S. Bureau of Standards, have proposed somewhat similar team-play in marketing and production surveys which need for their complete success the impartiality and the authoritative note of Federal administration.

This latest partnership in research, as between private industry and the Government, did not lead straightaway to a probe of machinery obsolescence. The first outside backer of a special inquiry was the National Association of Leather Glove and Mitten Manufacturers. And the program was solely a scrutiny of various phases of distribution. As the idea took root, however, the scope was extended from industrial marketing to industrial equipment, from which last it is but a short step to the problem of the widespread use in American factories of outdated equipment. The study of the history and performance of specific knitting machines in individual plants was planned to translate, in terms of dollars and cents, the consequences of delay in scrapping equipment which is a drag upon plant efficiency.

With the Division of Domestic Commerce thus drawn into the enterprise on the side of the Government, the Obsolescence Study has become the joint charge of the Domestic Commerce cog and the Industrial Machinery Division. The contribution of the latter is important in that it has enlisted the support and co-operation of the machinery builders—individual firms as well as organizations such as the National Machine Tool Builders Association. No sooner had the Federal fact-hunters entered the first plants on their lists than they discovered that it would be impracticable to obtain from the users complete "biographies" of the individual machines. In many instances, plant records failed to show when machines were purchased or what was paid for them. In some instances it was not indicated whether machines were new or second-hand when purchased. In this dilemma it was indicated that only the records of the machinery builders will fill gaps in the background of the obsolescence studies. This supplementary service is now assured and in return the machinery houses will receive information regarding replacement policies which should enable more efficient arrangement of manufacturing schedules.

Federal searchers for the truth regarding machinery obsolescence thought at one time that the schedules of the current U. S. Census, notably the Census of Manufacturers, might admit of the addition of questions that would give key to the toll taken by obsolescence. This idea has been abandoned. Revised opinion is that appraisal of individual machines is the only dependable means of gauging sufficiency of service. Individual inventory for obsolescence takes cognizance of the type, model and size of the machine, floor space occupied, productivity, power consumed, repairs expense, and deficiencies in output for which the age, condition or character of the machine may be blamed. The surveyors hope to be enabled, in the last analysis, to determine when new machines have been purchased to replace the obsolete and when to meet depreciation. It is possible, they think, that a "replacement cycle" may be revealed—an average "expectancy" for important developments or improvements in a given class of machinery or equipment.

New Du Pont Color

The Dyestuffs Department of E. I. Du Pont de Nemours & Company have placed on the market a new color to be known as Sulfogene Navy Blue 4R. According to the announcement it is a reddish sulphur blue, similar both in regard to fastness and dyeing properties to Sulfogene Navy Blue RL, but redder and brighter in shade.

It is claimed that Sulfogene Navy Blue 4R is fast to light, water, acids, alkalis and perspiration and is one of the best sulphur blues for cross-dyeing purposes. Due to its good level dyeing properties, as well as its solubility, it is suitable for use on all types of machines. It is expected that Sulfogene Navy Blue 4R will be extensively used for cotton goods, both when dyed in the yarn as well as on raw stock and in the piece.

As it is the reddest in shade of Du Pont sulphur blues now on the market, it will be suitable not only for self shades when redness of tone is desirable, but also for combinations where a sulphur color possessing this shade along with fastness and good working properties is required.

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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APRIL MEETING OF LOWELL JUNIOR SECTION

THE April meeting of the Lowell Textile Junior Section was held in the textile chemistry lecture room at the Institute April 10 at 3 P. M. The speaker was W. H. Cotton of the General Dyestuff Corporation, New York City. Mr. Cotton spoke on "Problems which Face the Young Works Chemist."

The meeting was adjourned at 3:50 after giving a rising vote of thanks to Mr. Cotton.

ALFRED J. CARBONE, *Secretary.*

Problems Which Face the Young Works Chemist

By W. H. COTTON
General Dyestuff Corp.

WHEN Prof. Olney asked me to address a few words to you to-day I wondered what subject might be of general interest to you, and I thought that perhaps I might make a few remarks on the problems which face the young chemist when he has graduated from his technical college and commences his work in a textile mill. Now you are all having or have had a good technical training such as a technical college can give, and it is most essential for a works chemist to have a good foundation on which to build, but you will find that when you leave your college and enter mill life many problems will be submitted to you which are very different from the work you have been doing until now. In former days mills were loath to engage chemists, as they were of the opinion that it did not pay them to do so. Dyeing and printing were carried on by practical dyers and printers who had no knowledge of chemistry and who worked according to formulas which they had either acquired or worked out empirically themselves. I am glad to say that those days are over. Most mills know that young chemists soon pay for themselves if they are given the facilities to work and the authority to introduce new methods. Now, in many cases one finds chemists at various mills, but I am sorry to say that very often they are not given laboratories or sufficiently well equipped laboratories in which they can make their experiments. This is quite a wrong standpoint. One cannot expect any good work from a chemist if you do not give him the means to work with. One might as well ask a carpenter to build something without or with inadequate tools. I would therefore strongly urge you, if you have not the facilities for working which you should have, to try and do your best to persuade your managers to equip for you a laboratory with all the conveniences you may require.

A very important work which young chemists have to

attend to and which, in my experience, is not given sufficient attention by the textile schools is the determination of colors on the fiber. Very often samples of competitor's goods are sent in to be matched, and in many cases it is of the greatest importance to be able to find out exactly with what colors the competitor's sample has been printed or dyed. I remember when I first joined a large cotton print works in Russia many years ago, how the manager came to me on the first day with about a square inch of a dark brown dyed piece of cotton with a white spot in it and he wanted to know how this sample had been made and what colors had been used. Altho I had had a very good chemical training at one of the best textile high schools in Europe I did not know how to go about this and had great difficulties and spent a lot of time before I found the correct solution. Of course it requires a great deal of experience in order to quickly and accurately determine how a certain sample has been dyed and what color has been used. Today in the most cases it is possible to do so, and perhaps it might be of interest to you to know how I used to tackle this subject.

The first step is to find out with what class of colors the sample has been dyed or printed. Let us take for example a printed bit of cotton. If you boil a part of the sample with diluted ammonia and the color is stripped then an acid color has been used. It is, of course, very seldom that acid colors are printed on cotton, but for some bright effects which do not require any fastness to washing but a good fastness to light, for example in tickings, acid colors are sometimes used. If the color is not stripped with ammonia then it is best to boil it with acetic acid. If the color is then stripped or bleeds very much the probability is that the goods have been printed with a basic color, but this is not alone quite conclusive. The next step is to determine whether the ash contains chrome. If there is no chrome in the ash then the goods have been printed with a basic color. If chrome has been found in the ash the sample is treated with hydrosulphite. If, when treated with hydrosulphite, it is found that the color is reduced but returns after washing on exposure to the air, then a dyestuff of the Gallocyanine series has been used. If there is chrome in the ash and the sample is a yellow or orange and the original sample turns black when treated with sulphide of ammonia then the goods have been printed with a chrome yellow or chrome orange.

Now, if the color has not been stripped or does not bleed badly with acetic acid and aluminum, chrome or iron have been found in the ash then treat with hydrosulphite. If the color is reduced with hydrosulphite and does not come back when exposed to the air, then it is a chrome azo dyestuff. If the color is more or less changed then it is a mordant color. Now, if the color is not stripped with acetic acid and no metal oxide has been found in the ash we must look further and treat the sample with hydrosulphite. There are only three possibilities: either the color is reduced and does not return on exposure to air, or the color is reduced and comes back when exposed to the air, or it is hardly changed by the hydrosulphite treatment. In the first case, if the color is reduced and does not come back when exposed to the air, then treat with pyridine. If the color is soluble in pyridine then it is an insoluble azo color produced on the fiber. If it is insoluble in pyridine then it is a direct dyeing color. By treating the sample with boiling soap and soda, and seeing whether it bleeds or not on white cotton, a direct dyeing color can generally be distinguished from an aftertreated direct color. In the second case, if the color is reduced with hydrosulphite and comes back on exposure to the air, then boil with tin crystals and muriatic acid using a paper saturated with acetate of lead to cover the test tube. A black spot on the paper indicates a sulphur color or a color of the Hydron group. The Hydron colors can be distinguished from the sulphur colors owing to the better fastness to chlorine. If the paper has not been blackened then it is a vat color. In the case where the color is not reduced but changes in shade and does not further alter on exposure to air, an oxidation color has been used.

With the help of these reactions it is possible to determine the group of colors which has been used. In order to identify the color further tests must be made. In the case of vat colors the color of the vat and the change of the shade caused by sulphuric acid should be determined. In other cases the action of concentrated and diluted sulphuric, nitric and muriatic acids should be determined. Spotting the goods with caustic and ammonia also gives a clue sometimes. In every case, however, when you think that you have identified a color compare it with a dyeing or print of that color, and only if you obtain the same reaction in all cases can you be fairly sure that your analysis is correct. Straight colors are fairly easy to identify in this manner, but when a mixture of colors has been used then it is more difficult to determine the various components. It is only considerable practice which will enable you to do so.

Certain colors have very characteristic reactions and can, therefore, be easily spotted. Such colors are, for instance, Alizarine Red. This color gives an orange when touched with concentrated nitric acid, dissolved in concentrated sulphuric acid and diluted with water and then neutralized with ammonia, a characteristic violet solution is obtained. Resorcine colors give a fluorescent solution in alcohol. Indigo gives a very characteristic yellow spot with a green edge when treated with nitric acid. Logwood is the only black which gives an orange spot with concentrated nitric acid. Ultramarine is decolored with

acid, whereas Prussian Blue is decolored with ammonia, but the original color returns with acid. These are only a few characteristic reactions that I might mention.

Another question which is very often asked the works chemist is to identify the fiber in a sample swatch. This is far easier to do. As you all know, wool and silk can be identified by the pungent smell which is obtained by boiling a small sample. Wool can be distinguished from silk as it is insoluble in conc. sulphuric acid, whereas silk dissolves in this acid. Cotton burns quickly with an unpleasant smell. Acetate silk is soluble in acetone, Tubize silk gives a blue reaction with diphenylamine and sulphuric acid. Bemberg and viscose can be distinguished as follows:

Dissolve about .2 parts of Diamine Scarlet 3BA in 100 parts hot water, dip the rayon in question for a few seconds in this solution at a temperature of about 160° F. and rinse in cold water. Bemberg silk will be dyed a heavy shade of red, viscose, on the other hand, will only show a very light stain.

I should also like to stress the fact that the works chemist should take the greatest trouble to know the characteristics of each color he uses and of new colors he wishes to introduce. Due to the fact that each color has individual characteristics it is not sufficient to know that a color is a vat or sulphur color and that it can be employed according to a general formula for that group of dyestuffs; for, in order to get the best results and the most out of the color, the most favorable conditions for that special color must be studied. The dyestuff manufacturers generally give in their circulars full particulars, but even these have to be modified according to the local conditions.

No end of other problems and difficulties face the works chemist. He has to determine whether spots or streaks which appear in the goods are caused by the bleaching, dyeing or the finishing. He must make suggestions as to how to overcome these difficulties. He ought to test all chemicals which are bought and used in a plant and to analyze the strength of the acids and alkalis used in the various processes. Often he is expected to make the soaps and sulphonated fatty acids in the plant and to control the finishes. In fact, all the time new problems appear, and this it is which makes the work of the works chemist interesting, if it is carried out correctly, and repays the firm. Above all things, work accurately and do not hesitate to state that you do not know something rather than make a positive false statement which may cause the mill you are working for great difficulties and expenses.

SPRING MEETING OF THE PIEDMONT SECTION

THE Spring Meeting of the Piedmont Section was held on April 12, 1930.

Samuel L. Hayes, Vice-Chairman of the Section, presided over this meeting. A great deal of interest was shown in the discussions of the following papers:

"The Trend to Refinement of Cotton Goods," Fred B. Voegeli, Textile Engineer, Hartsville, South Carolina.

"Application of Vat Colors in Printing," Dr. H. B. Marshall, Ciba Company, New York City.

"Application of Vat Colors to Cotton Yarn," S. H. Williams, General Dyestuff Co., Charlotte, North Carolina.

"Application of Vat Colors to Cotton Piece Goods," N. R. Vieira, Newport Chemical Works, Greenville, South Carolina.

Brown Mahon, first chairman of the Piedmont Section six years ago, spoke briefly on the early beginnings of the section, when there were about 15-20 interested members.

A very enjoyable entertainment was provided by the local committee, consisting of Dyer Moss, Chairman, T. R. Johnson, J. C. Cosby and Geo. Feindel.

H. A. Barnes of the Proximity Print Works was appointed as our member of the Nominating Committee of the officers of the Parent Association to voted on next December.

It was voted to have the Summer Outing in Charlotte, Myers Park Country Club, about July 12. A very complete program of sports, etc., is being arranged by the local committee.

Attendance at April meeting, 175.

A. R. THOMPSON, JR., *Secretary.*

The Trend to Refinement of Cotton Goods

By FRED. B. VOEGELI
Hartsville, S. C.

WITHIN the memory of our generations the customs and modes in the use of cotton goods have undergone a remarkable change. The fair sex has been largely credited with having caused this transformation, although there are more potent forces behind it. It can be said, however, that the ladies certainly contributed to a large measure by ready adoption of the changes offered. The latter, however, did not benefit the consumption of cotton goods very much, for with the greater development of rayon, our fair ladies took to the glitter and lustre of this regenerated product. Now, rayon was in existence many years ago but its general use dates back only relatively few years. Did the public readily adopt rayon? No, it was a long drawn out process, but the silky feel, the beautiful lustre, its sheerness and its appeal to the eye and

sense of beauty finally overcame its shortcomings, partially relegating cotton and silks. Frequent style-changes, the desire to be in fashion, and the exploitation of every whim and occasion caused the quality to be placed second in choice, as long as the appearance did not suffer. The cloth usually lasts long enough for the next creation to make its debut. Underwear, dresses, stockings and even hats are being offered "made of rayon." The public has thoroughly become accustomed to wearing apparel made of silky, fluffy, smooth, soft and delightfully lustrous material. The first thing a woman does, when she buys material, be it in the piece or made up, is to feel it. It must be soft, it must be sleek, it must drape, it must be glossy, it must look refined, it must be appealing. And this is not confined to the ladies, but applies to almost everyone. We have educated the public to these fine sensibilities, to beauty and color and it is these ingrained qualities that are now expected of cotton goods.

In confining ourselves to cotton goods it raises the question, just what is necessary to obtain these results? The bleacher, dyer, finisher and printer, of course, are expected to produce them. It is their business. If we are to go by the usual practice, any raw material will do, from sweepings to fine Egyptians, as long as the grey goods comply with the expected standard of count, weight and price. The miracle is supposed to be performed by the finishers, but the results are not always as expected. Of this a little more later on. I believe there is no branch of the cotton goods industry that exerts itself more over achievement than the finishers. The finishing industry to my knowledge is one of the few industries in this country that has the distinction of turning out a product at lower prices than any of their European competitors. Along with efficient cloth manufacturing they have contributed to put on the market serviceable cotton goods, which the poorest of our people can afford and thereby have become one of the greatest benefactors of mankind. Constant adoption of chemical and mechanical developments, efficiency in plant management, and a genuine desire to serve have brought about these results.

Before, however, the miracles can be performed, a few fundamental requirements must be complied with and one of them refers particularly to the proper selection of raw material. From the finishing standpoint, a lustrous cotton will produce the best results. The lustre that the cotton possesses can be increased by subsequent mechanical and chemical processes. The more lustre the raw material shows the greater will be the lustre after finishing, and therefore, wherever the final result calls for a highly lustrous fabric it is necessary that great care is exercised in selecting highly lustrous cotton of good color and twist. Combining of cotton adds a great deal to the finesse of the final finish and gassed yarns add to the lustre. The ideal for fine fabrics are yarns which are gassed and combed. With such a foundation to work on it becomes easier and possible to meet the exacting requirements of the consumer. The subsequent refining processes are many and varied. Not enough stress can be laid upon thorough singeing. It is the backbone of a finish, upon which the following processes are built, namely:

Bleaching
Mercerizing
Treatment for permanent finishes
Dyeing, Printing
Framing, Calendering and
Lustering.

By far the most important of these treatments for the production of lustre, smooth feel and fine appearance is mercerization. It adds that silky touch the public is looking for, but has also a number of technical advantages. In dyeing and printing it produces more brilliant shades with less color consumption, a very important feature in the case of expensive vat colors or dark shades. It refines the yarn through shrinkage and imparts clearer effects. Of course, as mentioned, the degree of lustre depends entirely upon the raw material, the strength of the mercerizing liquor and its temperature. Dull cotton if mercerized under equal conditions, while showing increased lustre will be mostly benefited by more refined appearance. Lustrous raw material will show the mercerizing effect in its fullest measure. Mercerization also renders the fabric stronger and more absorbent which may be an advantage in a number of instances, such as towels or in coating. It also aids in creating a sheerer effect. Of particular interest is mercerization in the production of crepe effects or so-called seersuckers or crinkle cloth. Two methods are employed, namely, that of printing resist on the fabric and then mercerizing same, or by direct printing of a strong paste of caustic soda on to the goods. In both cases the shrinking effect of the caustic soda will cause the crinkle.

Mercerization has not been adopted as universally as it should be, on account of its cost and difficulties encountered. There is, however, no more reason why most of the cotton fabrics should not be mercerized, for late developments in the process as well as in the mechanical handling has reduced the cost and risk to a point where more universal adoption seems warranted. Not only should it be adopted for wearing apparel, but for every kind of cloth, where greater strength, more absorption and better appearance are advantages.

Under the heading of "Treatment for permanent finishes" I am referring mainly to the treatment with acids as against the permanent finishes produced by spraying with waterproof substances. The acid treatments, while known for a great many years have come into vogue only during the last decade or two and consist of saturating the cloth with sulphuric or nitric acids, quickly removing same afterwards. Very beautiful and permanent effects have been produced, particularly on sheer goods. The affinity

to color is greatly increased by these processes, in fact, more so than in mercerization, but the inherent risks in handling highly concentrated acids and consequently higher costs have prevented their general adoption. Some of the permanent finishes call for a combination process of mercerization with caustic and afterwards with acid.

Before discussing subsequent processes it might be interesting to mention some of the refining processes employed for goods, which are not to be bleached before dyeing. Where clean cotton has been used, or where the cleaning process of the raw cotton has been carried out far enough so as to produce grey goods free from motes, no further cleaning, except singeing is necessary, before desizing. But in most cases, where singeing does not suffice to clean the face of the goods, sanding, brushing and shearing machines remove the greater part of the surface impurities.

It is not intended to go into the intricacies of dyeing and printing except in so far as it affects the improvement of the fabric. There are some goods which should not be dyed, for they are not improved by it. I am particularly referring to goods containing unripe fibres, which remain white. Generally speaking, goods take on more weight in dyeing and always feel heavier than in the white state. Printing, of course, improves the cloth, in fact, in the case of low count qualities, it covers the shortcomings of the cloth. An 8.20 print cloth, for instance, could not be sold for dress purposes in plain shades, while printed in a well covered pattern it is suitable for this type of fabric. The unprecedented development of really fast colored prints has made printed goods very popular, especially when produced in a lustrous, silky finish with brilliant hues. Printed dress goods will remain popular, if future creations in design, mode of printing and finishing are made appealing. Here again it would pay to mercerize most goods, the colors will come brighter and in case of discharges, the design will appear sharper.

Calendering exercises important influences upon the appearance and final finish of the goods. It is the combined utilization of moisture, heat, pressure and friction; which if varied, will, in the hands of a skilful operator, give a multitude of results. There are generally speaking four types of calenders, namely:

Straight rolling calenders.
Chaising calenders.
Friction calenders.
Shreiner or embossing calenders.

The straight rolling calenders are well known and serve to smoothen the fabric, adding some lustre. Chaising calenders are used for closing up open fabrics and to produce lustre. It differs from the straight rolling calender in that the cloth is carried through the calender continuously a number of times, sometimes as high as ten times. A five-nip calender, for instance, would consequently give 50 nips. The ends being run on top of each other, not only spread the individual threads thus closing up the cloth, but also leave the threads rounded, giving them a linen-like appearance. This is accentuated if rolls of considerable resiliency are used. For very high finishes combinations of chasing and frictioning are employed.

Friction calenders consist mostly of 3 roll calenders, one roll of which travels faster than the remaining two, thereby producing friction and a very high but unnatural lustre. A still higher lustre is obtained by the so-called Hall calender, the top roll or friction roll of which lays in a slightly angular position over the lower roll, thereby producing a rubbing effect, resulting in a very high finish. In this case, however, both rolls run at the same speed. Friction finishes are called for where a glazy surface is required and in a great many instances, where they are used as a preparatory operation for schreinering or embossing. For this purpose a friction finish furnishes the foundation for a high lustre, which by schreinering is being subdued and refined.

Schreinering is a process named after the inventor, Dr. Ludwig Schreiner, and consists of embossing the cloth with a design representing fine lines of various angles. The number of lines per inch depend upon the quality of the cloth, fine fabrics usually require finer lines or more per inch. The angle employed depends upon the type of fabric. As a rule the best results are obtained if the lines to be embossed run parallel with the twist of the yarn. Here again moisture, heat and pressure play an important part. The higher the moisture and heat the more permanent will be the resultant finish. Very beautiful and silk-like effects can be produced in this way on fabrics made of a high type of lustrous cotton, combed, gassed and mercerized.

Lustring is usually employed in case of goods where a deep-seated lustre is required, but where calendering and schreinering would eliminate the character of the cloth. The goods are being passed over highly polished and heated steel rolls, which revolve faster than the cloth. The latter is carried over these rolls by means of a felt blanket. The results are a fine, silky, subdued lustre, approaching the appearance of delustered rayon.

I have now only touched upon the high spots of finishing highly lustered cotton fabrics, but there is one refinement which the trade is calling for more and more, namely, pre-shrunk fabrics. There have been many complaints of late about excessive shrinkage after the first washing and these complaints are quite justified. To get to the bottom of the trouble a short history of the developments of cotton goods manufacturing and the requirements from the finishers is necessary. When plain looms were used for weaving the contraction of the warp

amounted to from 5 to 10%. Such cloths, if put through the regular finishing process without special stretching devices, would gain from 2 to 3%. The converters, who received the benefit of this gain, had become accustomed to such an overage and usually considered same in their price calculation. Subsequent improvements in looms, notably the automatic warp let-off reduced the contraction of the warp to from 1½ to 2% and in most cases where goods from such looms are put through the finishing process without special stretching devices, the result is a loss in length, which is further aggravated by calendering and other means of stretching by the mill in the grey state and before finishing. The demands by the converter for gains to which they had been accustomed to forced the finishers to adjust their processes so as to produce gain at the expense of quality and appearance. Such cloths will shrink unreasonably after the first laundering process and its remedy lies in the elimination of stretching processes at the mill and by the finishers. The goods should be finished naturelle and without undue tensions and the converter should accept conditions as they are. The width also has considerable influence upon the shrinkage. Goods should not be finished to grey width, save where the finish requires it, but should be allowed its natural shrinkage, which will be less, if excessive tension in lengths is eliminated. Such cloths will furnish little cause for complaint as regards shrinkage after the first washing. In special instances, however, where a full shrinkage is required, a final shrinking process must be resorted to. Usually same is divided in a cold and hot water process. Goods are subjected to a bath for varying periods and then dried loose in loops or carried through a dryer on nets avoiding every semblance of tension. However, proper selection of raw material, proper method of spinning and weaving and careful finishing will do much to produce a piece of cloth which will not shrink. There are a number of cotton goods manufacturers who do their own finishing and who manufacture their cloth to fit their finishing processes. They have few if any complaints as regards shrinking after goods are washed and until this method is again employed in general we will have the shrinking evil with us.

There are many agencies busily engaged with trying to devise means and ways for the improvement of lustre, smoothness and feel of cotton fabrics and these efforts are not confined to the higher grades of goods, as is exemplified by a fabric, which has come under my notice, made of No. 1 or No. 2 cotton yarn, counting 16 threads both warp and filling and which through skilful spinning and finishing produced an article selling from $1.50 to $2 per yard. But until we pay more attention to the lustre of the raw material or cotton, we shall find it increasingly more difficult to make progress in supplying the popular demand for a silky cotton fabric. The breeders of cotton, especially in this State, paid particular attention to this feature and fine, silky staple cotton is available in increasing quantities. With proper recognition there is no reason why a large crop of cotton with such characteristics will not be grown. But it is up to the mills to become discriminating in their purchases and give credit where credit belongs.

Application of Vat Colors in Printing

By Dr. H. B. Marshall
Ciba Company

THE origin of printing, undetermined at the present time, harks back to the Middle Ages when fabrics were decorated by hand painting in the Far East. This method was altered by Europeans who obtained the same effects by the use of blocks, thereby starting a process which was later to revolutionize the textile industry. The Perrotine was the natural sequence to the block printing by hand, this procedure having as its basis three or four blocks affixed to a cylinder which could be revolved and each block printed as its color was called for.

With the ever-increasing demand for greater variety and larger production the printing machine was invented as the only method to meet the situation. In respect to colors the same phenomenon was apparent. From the use of natural colors we have the advance, step by step, thru the basics and chromes to the vats. The aptitude of woman for changing her tastes as well as her mind necessitated a range of colors which could be subjected to the most stringent tests as to fastness to light, washing and wear, and science's answer to this demand is vat dyestuffs. Manufacturers and finishers welcomed this change because of the greater production afforded, due mainly to the shortening of the period of steaming from one hour to five minutes. Women of moderate means welcomed the change because it was made possible to obtain a wide variety of patterns of fast colors on cheap fabrics, and this fact brought to both finishers and retail men the necessity for vat prints.

The forerunner of the vat dyes is the old Indigo, a natural coloring matter used for centuries and at present manufactured synthetically after the method of Heumann. This discovery opened up the field of research in vats, the finding of indigoids from the halogination of indigo, and the anthraquinones. Indigo was first successfully printed on cotton by the use of glucose which performed the reduction of the indigo into its soluble form. This method is the most simple, but the printing pastes are not very stable and are apt to give varying results. The method of printing Indigo on a glucose prepare is more satisfactory, the procedure, consisting of padding the pieces in a solution of glucose, drying, and printing the

paste containing thickening, indigo and alkali. After drying, which should be done as soon as possible, because of the danger of the caustic soda's absorbing carbon dioxide from the air and producing neutral $NaHCO_3$ + Na_2CO_3 which reduces the alkali content of the paste below the point which will permit reduction of the indigo by the glucose, the material is aged and washed in cold running water.

When it was discovered in Russia that the addition of formaldehyde made sodium hydrosulphite stable in neutral and alkaline solutions, another advance in printing of vats was made. This practically sounded the death knell for glucose as the reducing agent, and immediately the use of sodium sulphoxalate formaldehyde caused a greater adoption of indigo to calico printing. For the printing paste the required amount of Indigo is mixed with an alkaline thickening, containing gum and alkali to which is added the necessary amount of Hydrosulphite NF Conc., Rongalite C. or Formopon, as the case may be. After printing, the goods are aged from 3-5 minutes and washed and soaped to remove alkali and oxidize the color.

As the indigoid, carbazol and anthraquinone dyes were developed they were also applied in printing, printers and colorists applying to them the same methods which experience with Indigo had taught them. It was found that the reduction with hydrosulphite proved to be the most satisfactory and in time the use of glucose gradually was dropped. At the present time there are three methods of printing in general use, all using the hydrosulphite principle. The first, known as the so-called unreduced, consists of mixing the dye paste with a gum containing the carbonate of either Sodium or Potassium and glycerine, to which the required amount of hydrosulphite is added. Should the mixture of dye paste and thickening and hydro be allowed to stand for some time, a complete reduction of the dyestuff takes place, so unreduced would be a misnomer. The whole is printed, aged and soaped. By this method all Indigoid and Carbazol and most anthraquinone dyestuffs may be printed and full color value obtained.

The second formula is based on the use of Caustic Soda as the alkali and the pre-reduction of the dyestuff with concentrated hydrosulphite powder. Here the formula might be given as

10-20 lbs. Dye Paste
6 gals. Thickening consisting of
30 lbs. Gum
1½ gal. Water
1 gal. Glycerine
15 lbs. Potash
1½ gal. Water
¼-½ gal. Caustic Soda 72° Tw.
3-5 lbs. Hydro Conc. heated to 120°-140° until reduced
3-5 lbs. Hydrosulphite NF Conc. and water to
10 gallons.

By this method the dyestuff is partially reduced by the action of the Hydrosulphite powder which some claim to give better results.

The third method embodies the same principle with the omission of the caustic soda. The main variation in the three formulae is the alkalinity, and they are employed as to the nature of the dye. With some of the anthraquinones the full color value is not obtained unless there is Caustic Soda present and others are so slow in reducing in the cold that it is necessary to heat with the hydrosulphite before printing.

It is the general practice among printers to use dyestuffs in paste form only, this due to the ease in handling and the ability to have an even suspension of the dyestuff when printing unreduced. On the other hand if the dyestuff is reduced before printing why would it not be feasible to use the dye in powdered state? It is my opinion that a more complete range of colors is available in the powdered than in paste form. Powders are much less bulky than pastes, leave more room in a color shop for tubs to stand on the floor in pre-reduction or partial reduction and give as good results if properly handled.

Until quite recently due to the demand for production, most color mixers have had to be content with mixing the dye paste with the alkaline thickening and hydrosulphite formaldehyde in the cold and rushing it to the printing machines in the cold and unreduced. This often resulted in speckiness, doctor blade streaks, snaps and the like, resulting in loss of time and money. It is logic that very fine pastes are of utmost necessity especially in those dyestuffs which are slow reducing, otherwise there will be uneven dispersion and the results mentioned above. To offset this trouble many printing establishments have installed colloid mills, machines which grind by means of friction at high speed, and demand that all colors are run thru these mills either before or after mixing with the printing thickening in order to insure only the most finely divided substances. The advantage of such machines is that it is possible to leave the printing gum as well as the dye paste without lumps or any large particles which would cause trouble in the machine. Other establishments advocate the addition of certain chemicals to the paste, in this way attempting to bring about a finer division of the dyestuff particles. Each of these aids to giving more even pastes naturally tends to give a more even fixation of the dyestuff on the fiber in the ager.

Aging, in the opinion of many, is the keystone of success in printing. One may have the most skilful printers

and colorists, but due to the wrong conditions existing in the ager, obtain poor results. The modern rapid ager differs from the old style in that each roller is geared to a common drive chain, thereby doing away with any excess tension on the fabric. The roof is equipped with a series of steam pipes thereby allowing no condensation of the steam to drop on to the cloth, making spots. In order to keep the correct amount of moisture in the ager, water pans are built into the bottom of the ager, with steam coils passing thru them. In spite of all these precautions many still have trouble with their agers. The most ideal steam for use in the rapid ager, where the goods are fed in cold and with no previous freeing of air, is a saturated steam. By saturation we mean that the slightest lowering in the temperature will cause the water to separate in the form of a mist and condense on the walls of the ager. A slight rise in temperature will cause this to be reconverted into superheated steam which is not moist as we know it. Barometric pressure is also a factor in the temperature of an ager, for should the pressure of the outside air and the temperature in the ager be a little low and the steam not superheated sufficiently, then the colors will not be fixed on the fabric and tend to run out on washing. That it is a fact that goods run bone dry into the ager absorb a great deal of moisture is shown in the following illustration. A well known printer of silk was having trouble in that the colors washed out after aging with the exception of the first few yards run thru the box. On investigation it was found that the silk was taken immediately from the dryer after printing and aged. As it is a known fact that silk absorbs 12 per cent moisture the logical conclusion drawn was that the first few yards of the piece run into the ager absorbed all the moisture in the steam so rapidly that the rest of the run was subjected to only dry steam which has not the fixation power of moist steam. By allowing the pieces to stand in the air for a short time the moisture content of the fabric was reached and on aging satisfactory results were obtained.

Due to the demand for fast dyes, many small screen printers attempted to print vats and use a cottage steamer in place of an ager and wondered why they had no success. Such incidents as this are more apt to cause destructive rather than constructive criticism and shows the necessity for educating the smaller finishers in the use of vat dyes.

It is the custom of most printers and color mixers to make their own thickener, although certain chemical houses put prepared gums on the market. The most common of the former are starches, British and Arabian gum and tragacanth. For ordinary shirtings and dress goods starch converted or partially converted with diastafor, and British gum are generally used, while for more delicate fabrics gum tragacanth or a less costly mixture of tragacanth and converted starch is very satisfactory. Due to the ever-increasing use of mixtures of cotton and rayon, it is necessary to use a gum which gives a good penetration, although in this case not to the same extent as in pure rayon or silk. The main thing is to have a gum which does not form lumps, flows smoothly and allows a smooth dispersion with the color paste.

Since the general adoption of vat colors, the cry has always been for brightness. Here another element of the process enters in. Vat dyestuffs must be soaped at the boil to insure maximum brilliancy. It has been found that if the dyestuff molecules reoxidize in large crystals there is a lack of brightness. The more finely dispersed the reoxidized particles are, then so much more is the color value due to the better reflection of the light rays from the more even dispersion of the color.

The demand for color prints on a dyed ground have opened up fields for research, resulting in the possibility of producing a fabric fast to light and washing. This was produced by discharging anthraquinone prints on indigoid dyed ground when it was found that by combining Leucotrope W with sulphloxylate formaldehyde the printing color remained quite stable. It was also found that after printing this color discharge on the dyed ground if the goods were passed thru a hot caustic solution, the colors were not dulled. Thus it was found possible to obtain on cotton even better fastness than is found with rayon or silk dyed with developed colors and discharged with vat dyes.

Application of Indanthren Colors on Cotton Raw Stock and Cotton Yarn

By S. H. Williams
General Dyestuff Corporation

DUE to the various methods employed to-day in the dyeing of cotton raw stock and yarn, the time allotted for this subject can by no means cover this line of work.

The factors that govern the dyeing of raw stock are small in comparison to those for the dyeing of yarn. The selection of the proper dyestuffs and colors that dye best together is always a matter of great importance.

However, before a dyer can select the most suitable dyeing types, he is first confronted with the specifications required of the colors in regards to fastness.

The material in which the color is applied may be used for a special purpose, which may limit the dyer to a choice of a few colors. An example of this special fastness is the government's requirements on khaki shades. Indanthren Yellow Brown G is a new color that meets the government's requirements that practically matches their shade. This eliminates the old three-color combination that has been used for this work.

After selecting the proper combination and the shade is matched, there are five steps that actually have to be observed in the application of the formula.

1. The preparation of the material before dyeing.
2. Reducing the dyestuff.
3. Actual dyeing time.
4. Complete oxidation of the colors.
5. The final soaping and developing of the shade.

The preparation of both yarn and raw stock has been widely discussed and to-day we find dyehouses producing satisfactory results by both boiling out the stock and by dyeing with the use of wetting out agents added directly to the dyebath.

The physical properties of the machine along with the type of material to be dyed are the factors that govern the necessity of boiling out previous to dyeing.

The reduction of vat colors is an operation that must be done carefully in order that each dyeing may check to shade.

The operation of reducing a color is often left to an operator of a machine, who through his lack of dyeing knowledge becomes careless and fails to give the vatting of a color proper attention.

The amounts of water employed in the reduction tank along with the temperature are two factors that need watching after the proper amounts of caustic and hydrosulphite are calculated.

After reducing a few colors, the operator no longer wonders or seems amazed at the change in the appearance of the vat when the hydrosulphite is strewn in.

Like everything else, it becomes a simple procedure and the day comes when he is late with his work and sees no reason for waiting the required time before entering the dyestuff to the machine.

The result is the batch does not come up to depth in shade and possibly has a color precipitate on the bottom.

In reducing Indanthren colors for machine dyeing, which is generally carried out in a small reduction tank, the following precautions should be observed:

Water free from lime should be used and if only hard water is available it should be corrected with a lime dispersing agent such as intrasol, one ounce per 10 gallons being sufficient for this purpose.

Precipitation on the outside of the batch of stock is often the result of lime in the water.

The amounts of water used in reducing colors should be given careful consideration, this factor being governed by the amount of color to be reduced. 1 to 2½ gallons of water should be used based on single strength paste.

If this is not observed heavy shades are liable to filter off on the outside of the batch.

If the amounts of color are too great for the size of the tank in which they are to be reduced, which is often the case on heavy shades, the dyestuff should be split in two portions and reduced in this manner.

Should a combination of colors in the same formula require different reducing temperatures, it is the best practice to reduce them separately so that each type may be given the proper attention.

Indanthren types that should be particularly watched in this case are marked in our literature "to be dyed by special process."

The amounts of caustic, hydrosulphite and salt should always be calculated on the amount of water the machine contains and the type of dyestuff used, and not on the weight of material.

After calculating the proper amounts of caustic and hydrosulfite it is often found that the total amounts necessary to be used in the dyebath, are excessive amounts necessary for reduction.

This always being the case when dyeing with long liquor ratios. The excess caustic and hydrosulfite not used in reducing the color is added directly to the dyebath as a spring to condition the stock. Circulating the caustic and hydrosulfite used in springing along with the retarding agent for 15 minutes is advisable before entering the reduced color to the machine.

If a protective colloid is used to retard the dyeing action, such as glue, this product should be based on the volume of liquor. One to two pounds per 100 gallons are the amounts generally used on raw stock in practice.

Glue is not necessary when dyeing with the IW and IK types of Indanthren colors as these types level without difficulties.

If a retarding agent is used with these types there is a loss in the value of the color and the full shade will not be obtained.

The majority of the vat colors dyeing on raw stock is generally carried out in the pressure machines, but it can also be done very satisfactorily on revolving types in the following manner:

For this work the paste brands are more suitable. The cotton is first wet out with 1 to 2% Prestabit Oil V at the temperature the dyeing is to be done.

The dyestuff paste mixed with hot water is entered into the machine in pigment form along with the required amounts of caustic. After circulating the color thoroughly through the stock, the hydrosulphite is added at reducing temperatures and dyed from ½-¾ hour.

By this method the stock is completely dyed and far better results obtained than by adding the pre-reduced color to the machine.

Indanthren colors should be soaped to obtain their proper fastness but this cannot be successfully done on raw stock. The soap should be replaced with soda ash or a lime dispersing agent such as intrasol. If intrasol is

used a full development of the color is obtained; 12 to 16 ounces per 100 gallons of water is sufficient for this purpose.

A careful rinsing after dyeing is essential to remove all traces of caustic. Caustic left in raw stock cotton often gives trouble in the card room.

The dyeing of cotton yarn with Indanthren colors covers two distinct fields, open machine dyeing and pressure machine dyeing.

The matching of shades in this line of work is a continual problem for the dyer, as the colors needed for shading purposes are often types of different dyeing qualities than the major color used in the formula.

It is not a wise idea, or economy, to limit a dyer to a choice of a few colors. This practice often results in a number of unbalanced formulas that are hard to check.

The use of a retarding agent in a combination in which each color exhausts differently is not good practice and should be avoided when possible.

It is advisable when dyeing with an unbalanced formula to adhere to the method best suited for the major color in the combination.

The range of Indanthren colors has enlarged so in recent years that this practice can be cut down to a great extent.

Bad color combinations can never be depended upon and the re-working of off-shade yarn is not a pleasant task for the dyer who has no blacks to fall back on.

In light shades for pressure work, extremely level colors are the types looked for, while in heavy shades liquor ratios a color must be of excellent solubility.

Clear package and yarn of good fastness to rubbing are the objectives of a package dyer of fast colors.

Heavy shades of black were somewhat poor in this respect until the problem was solved by the manufacture of Indanthren Direct Black RB, a color of excellent solubility for pressure work which requires no after-treatment for developing.

Complete oxidation should be carried out before the soaping takes place. This is sometimes overlooked as it is common practice to enter the soap into the oxidizing bath at low temperatures and then bring to a boil.

Ordinarily this practice will give no trouble but if very slow oxidizing colors are used, and they are soaped before complete oxidation, the shade is dulled and the inside of the package will be a different shade than the outside.

Skein dyeing on rotary machines with Indanthren colors offers a number of obstacles to the dyer, of a different nature than when pressure dyed.

If the colors are reduced in reduction tanks, the next step after adding the color to the machine is to complete the dyeing in the quickest possible time and to get full value of the colors.

Yarn that is in the air a part of the dyeing time has a tendency to oxidize and the dyebath must be sufficiently strong in hydrosulphite to re-reduce the yarn as it re-enters the machine. The amounts of hydrosulphite depend on the length of the dyeing time, coupled with the depth of shade produced.

Hanks dyed under water and the dyebath circulated through them are generally dyed in long baths and the total amounts of caustic, hydrosulphite and salt are large in percentage of the material as the quantities of these products are based on the total volume of liquor the machine contains.

The agitation of the dyebath has an important bearing on the hydrosulphite content. Identical machines often require varying amounts of hydrosulphite, due to the air brought into the bath by agitation.

It is always advisable to work with a slight excess of hydrosulphite to keep the color from falling out of reduction.

In dyeing combinations in long liquor ratios that do not wholly exhaust, too much care cannot be taken of the temperature and dyeing time, as 5 minutes and 10 degrees variance often alters the depth of shade.

In conclusion, I might state that vat colors are not mysterious in their actions, and, if the basic dyeing principles are carried out, the results are sure to check.

Application of Vat Colors to Cotton Piece Goods

By N. R. Vieira
Newport Chemical Works

PIECE goods dyeing is at the present time an extremely busy field for this most important class of dyestuffs. There are in general use four methods of application, viz.:

Jig Dyeing,
Reduced Padding,
Continuous Dyeing,
Pigment Dyeing.

In regular jig dyeing, which is, I believe, the oldest method, the bleached goods are wound on the jig beam and then passed back and forth thru the reduced solution of the dyestuff in the regular manner. This method gave considerable difficulty with penetration, heavy selvages and tapering of the shade within the roll, as well as differences in shade and strength from roll to roll. The selvage trouble was generally due to bad winding, the over-lapping edges oxidizing and redyeing a heavier shade than the rest of the material. This difficulty can be overcome by framing the goods or using a good winder with Foxwell guiders. Tapering can generally be overcome by careful feeding of the color or cutting down the

size of the roll. However, poor penetration on hard twisted fabrics or heavy goods is its main drawback as there is no way of getting a squeeze on the average jig. This method has in many plants been modified to the pigment method.

Padding, reduced, has been used with some success for light shades on easily penetrated fabrics and consists simply of padding the goods in a solution of the reduced color and either skying and dropping into box trucks or batching in a roll on the back of the pad, and subsequently oxidizing and washing on the jig. While extremely low in labor cost, it is very unsatisfactory as to washing fastness. The depth of shades and selection of colors suitable for it are also rather limited. Poorly soluble colors are apt to precipitate and result in cloudy or mottled dyeings. Colors that exhaust at about the same speed must be used or tailing will result. This difficulty can be overcome somewhat by the use of a small pad box. It is also essential that a careful study be made of the action of the various colors to be used in combination and then regulate the feed to offset the variations in exhaust.

Continuous Dyeing—This method is a modification of the padded reduced method, and gives good results on some types of work. This consists of passing the goods thru a reduced solution of the dyestuff on the padder and passing directly thru boxes containing Hydro and Caustic, and the thru wash boxes containing either water or an oxidizing solution, depending on the colors in use. This method is most suitable for mills producing a standard line of shades on their own goods. This gives the opportunity of running fairly large lots of a shade and stocking for later delivery. Short runs on new shades and continual changing of shades is apt to be expensive both in color and the time necessary for cleaning up the equipment after each run. Then there must also be added the cost of charging and feeding the re-reducing boxes which, for the best results should be kept slightly overflowing. Again the same points that apply to the reduced padding method must be kept in mind when selecting colors for use on a range, and while a great improvement over the reduced padding method, the maximum of washing fastness is not obtained. However, a number of plants find it suitable for some types of work.

The pigment method gives the best all around fastness and penetration on all types of goods, is equally suited for light or heavy shades in large or small lots, and permits the use of a great many combinations of color that the other methods do not. The shades are clearer, have a more solid appearance, and the process is about the easiest to control when established than any of the other ways of application. It does not require the use of expensive equipment that may be standing idle from time to time. A good pad and ordinary jigs are all that are required.

The goods are padded with the unreduced color in a suspending medium, transferred to the jig and passed back and forth thru a reducing solution from 4 to 8 ends, depending on the shades, rinsed and oxidized, and are then ready for the rope soaper. The selection of the suspending medium is quite important as a well-suspended, smooth-working, good-penetrating mixture naturally works to the best advantage. Various gums and dextrines are being used, but by far the easiest to prepare and apply is ordinary ground glue of good solubility. Gum Arabic is rather expensive, gum trag, unless thoroughly soaked, cooked and carefully strained will contain minute lumps which will pass thru ordinary straining cloth and re-form again. These will tend to coagulate the color with the formation of so-called color spots in the goods for which the dyestuffs are often blamed. Generally colors should be used that have been especially prepared into fine paste as the presence of small particles of concentrated color is apt to cause trouble with spotting in light shades. Difference in exhaust speeds and dyeing temperatures are not nearly as troublesome as in the other methods. When the goods are passed thru the reducing liquor in the jigs, the color, of course, does wash off to some extent. By far the greater part stays in the goods. The color that washes off when reduced goes back on the goods, and the retarding action of the glue is an aid in giving uniform rolls. Dextrines with some colors give a mixture that will foam quite badly and mark the goods. These foam spots are not removable.

Cotton in the form of piece goods is not as readily worked over as in the yarn, and imperfections in dyeing are quite apt to be permanent. Some of the troubles that are apt to develop cannot be corrected at the time, but provision must be made to eliminate them on the next run. The old bug-bear of heavy selvages is not present in the continuous reduced padding and very seldom in the pigment method. Of course, the old danger of losing the vat is always present, but as a rule everybody that is using vats today is fairly familiar with their control and this does not often occur. Although it must be remembered that an excess of Hydro is as bad as an insufficiency as it will neutralize some or all the alkali and thus precipitate the color.

Hard water is quite apt to be troublesome, as well as expensive, as a number of the vats are more or less

affected by it. However, most plants today are watching their water supply a great deal closer than they did a few years back. Variations in shade may be due to a number of changes in conditions of reduction, temperature both of reduction and dyeing, oxidation, soaping and sometimes in the finishing. In reducing vat colors the alkali concentration plays a most important part. With some colors an excess of alkali will cause precipitation, with others it will lessen its affinity for the fiber and thus impair their money value; with still others it will accelerate exhaustion and thus be a factor to uneven dyeings. Again an excess is sometimes hard to remove, and if left in the finished goods, will, in some cases, affect the tone of the finished shade. With some colors it has a decided tendency to change the tone entirely. Pink FF is an example of this. Excess of alkali produces a much bluer and duller shade than normal. Souring the goods after oxidation is an aid in preventing some of these difficulties, but again if the goods are imperfectly oxidized and soured, some colors are changed quite drastically.

Temperature control is very essential as many colors have variable exhaust rates at different temperatures. Flavone CG is an outstanding example of this. The lower the temperature, the greater the affinity for the fiber, and when used in combination with blue or green a difference in 10° temperature will make a decided difference in the ultimate shade.

Acid oxidation is suitable for some colors and alkaline more suitable for others. It is essential with a great many colors that the oxidizing process be complete, for soaping in the presence of the leuco compound will result in a dull and off tone shade. Yellow G is an example of this. While the shade will ultimately come over to its true tone, it sometimes requires as long as two or three days. The soaping itself should be as complete as possible, as practically all vats undergo a decided change in shade in this final process. Yellows will redden, the golden oranges will turn yellower, the blues, redder, etc. A rope soaper, is as a rule, the best to use, the machine being so threaded and speeded to give the goods from 8 to 10 minutes in the soap, which should be kept as close to the boil as practical.

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NOTICE

There is an opening at present for an instructor to teach Chemistry and Dyeing in the Paterson Vocational School, Paterson, N. J. The opportunity is an unusually fine one, and it is felt that some member of the Association might be glad to know of the chance to get into this all-important educational field. Further particulars may be had by communicating with James F. Mason, Director, Paterson Vocational School, Summer and Ellison Streets, Paterson, N. J.

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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A UNITED MOVEMENT OF RESEARCH

IT IS only occasionally in the lives of nations, industries or individuals that events of truly major importance transpire. Oftentimes these major events are not recognized at their face value until long after they have occurred. Probably very few persons then living realized the importance that later came to be attached to the declaration of President Monroe to the effect that the American continents were no longer to be considered as territory for colonization by European powers. Almost every individual can look back at some event in his life which at the moment seemed inconsequential but which in the light of later events proved to be a turning point in his career.

Such an event of major importance to the American textile industry will occur, in our opinion, on May 23, when delegates representing all associations, governmental bodies and educational institutions affiliated with the textile industry, meet at the Chemists' Club in New York City, to formulate plans for the organization of an all-embracing institute for textile research.

On page 300 of this issue there will be found a news story describing the meeting of several interested textile associations which was held at the University Club in Boston on April 30, for the purpose of considering the formation of some association for co-operative textile research. It is as a development of this meeting, and of a similar one held at the Chemists' Club in New York City, early in April, that the meeting of the whole industry has been called for May 23.

For many years the textile industry has been slowly awakening to the fact that it is woefully behind other industries of similar importance in the field of pure and applied research. Members of the steel industry, paper manufacturers and laundrymen, to mention but a few, have for years co-operated in exhaustive research programs for the benefit of their respective industries, and it is worthy of note that in these fields America is pre-eminently successful.

The textile industry, on the other hand, has done very little in the way of co-operative research. Certain individual mills, it is true, do maintain extensive laboratories and carry on rather extensive research programs, but without exception, these are devoted to the perfection of products or processes peculiar to that individual mill.

The American Association of Textile Chemists and Colorists is a leader among a very few co-operative textile groups which has made real efforts at organizing co-operative research and its efforts have necessarily been limited because of the narrowness of the field which it serves and more especially because of lack of funds. This Association, however, and in particular its president, Dr. E. H. Killheffer, and one of its past presidents and chairman of the research committee, Dr. Louis A. Olney, are to be congratulated in that they have done a great deal to arouse the textile industry as a whole to the need of research, and in this particular case has taken a leading part in sponsoring the meeting called for May 23.

The textile industry has been notably secretive as to its technology. Various mills have acquired the reputation of producing a certain fabric or a certain finish a little better than their competitors, and have guarded these processes with an almost fanatic zeal. That a policy of this sort tends to stagnation throughout an industry wherein it is prevalent, is quite obvious. This secretiveness has been common not only to manufacturing concerns, but to individuals within these concerns. Until quite recently families of dyers handed down from father to son certain "secrets" which even their employers believed to be invaluable. That most of these "secrets" are pure hokum and that free interchange of technical data produces far better results in the long run have been clearly demonstrated during late years, with the result that to-day the "rule of thumb" superintendent of processing is pretty generally discredited.

We believe that the eyes of the textile industry are now thoroughly opened to the fact that co-operative textile research on a broad scale, and beginning with the most basic truths regarding the various fibres, is a fundamental necessity if the industry is to grow and prosper in line with other American industries of comparable size.

Who can say that the depression of the present and recent past, throughout the textile industry as a whole, might not have been alleviated to a considerable degree had the industry years ago undertaken the vigorous prosecution of co-operative research? Various superiorities and economies of production would undoubtedly have resulted which might have enabled our manufacturers to absorb without disadvantage higher labor and other manufacturing costs as compared with the rest of the world.

The new movement is but a means to a beginning, yet it offers the machinery through which the entire textile industry—manufacturers, distributors and consumers—

may unite in a campaign to the discovery and recording for common use all that mass of fundamental information upon which all technical textile progress must rest.

Each one of the organizations included in the invited list is urged to give serious thought to the proposed institute for textile research and to appoint as its delegate to the meeting one of its officers who has the confidence of its membership and the authority to speak for it. In this way full and free discussion of every phase of the proposition will be had and it is our belief that the new institute will be launched under auspices so strong that its success will be assured beyond doubt.

Each of the invited organizations should realize that the proposed institute is one hundred per cent co-operative; that there are no ring leaders with axes of their own to grind; that those who have sponsored the invitation are actuated by the most altruistic of motives and that whatever machinery for research may be set up will be the product of the entire textile industry and not of any coterie or faction.

A. P. H.

Random Thoughts on Research

Textiles Not Like Other Industries

IT IS said to be a rather conspicuous fact that the present day industries that are most successful are the ones that are depending most on research. The implication is not necessarily true that textiles might profit equally from a similar great effort. This is too large a subject to argue in detail, but there are points of difference between industries.

Families that have never had automobiles are gradually acquiring them so that there seems to be some distance yet to go before the market will be saturated with this new commodity, and the business reduced to a replacement basis. How different from textiles for clothing. Each individual is "saturated" as soon as he is born and it is a replacement business from then on. There seems to be no opportunity to introduce any great brand new line at all comparable to automobiles, where there will be the normal expansion with population; a growing replacement business; and at the same time an extension in a field not yet occupied. No wonder there has been vast progress. Science has contributed very greatly to a better and less expensive car but other great factors have come into the picture.

Any great new discovery in textiles is not likely to open such a vast new market unless it is at the expense of something that is already established. We are all provided with clothes and few of us would very greatly increase our supply if something new came along. If adopted, we would take it up for the most part in place of something else.

Take mechanical or industrial fabrics. There has been a large expansion in such lines, but for the most part they are a plain sort of goods with no bleaching, dyeing or finishing. The experience of the Cotton Textile Institute in seeking new uses for cotton is instructive. Bringing cotton back into certain lines of clothing will replace some other fiber; using it for bags will replace paper or jute; while using it for road markers will extend the use of cotton without interfering with other textiles. Progress in new lines will apparently consist in the sum of many small increases, for there is little indication of any great new field.

The electrical industry is cited as an outstanding success for research, and so it is, but look at the opportunity that it has had. When the telephone was invented there was nothing else like it in existence. Science has perfected it and brought its complicated service to a low enough cost so that we all must have it. But, it had a brand new and certainly not limited field. The electric light has had competition, but it has been so far superior in convenience, and has been so improved by science in efficiency and reduced in cost that it couldn't help displacing kerosene and a large proportion of gas lighting. It has not had a worthy competitor, and therefore had an unusual opportunity.

The radio has also opened an entirely new field and given us something that we did not have before.

There may be lurking in textiles new and undreamed-of fabrics that will be as far superior to those now in use as the electric light is to the kerosene lamp, or the electric refrigerator to the ice-box. There may be some that will perform for us entirely new functions, as the radio has done for entertainment. However, I think that few of the most enthusiastic enthusiasts can quite believe it if they stop to think of all that is involved. There may be and there undoubtedly are revolutionary changes in processes in store for us. They will upset some of the balances in the textile industry, causing shifts in fiber uses based on new economic ratios. Can they mean much more than shifts—some new or old fiber brought into new uses at the expense of some other fiber already established there?

Rayon is the prize example of a new fiber developed by chemistry making a great and growing place for itself in textiles. It is hailed as having a new field of its own, and minimized as a competitor of natural fibers. Has rayon a field of its own from the point of view of the older textiles? It has been very valuable to users of wool and silk and cotton in new designs and novelties, to help meet or make competition; cotton or silk mills have been enabled to stay in business by its aid. But, in last analysis has not rayon made its way by replacing a little wool here, some silk there and still more cotton elsewhere? Is there any amount of rayon in use today where, if we did not have rayon, we would not be using some other fiber and getting along very well?

This little discourse is not intended as an argument against textile research, because there are plenty of other reasons for it presented elsewhere in the series. It is merely a warning not to paint too rosy a picture and perhaps fool yourself by believing it. Take it from one who

has puzzled over many problems in textile research that there is not any orchard full of plums ripe for the picking. There is a field for good and useful research but we cannot in our enthusiasm unintentionally misrepresent it.

Hubbard Dry Cleaning and Re-dyeing School

There has recently been established through the efforts of C. C. Hubbard, formerly Director of Research and Education for the National Association of Dyers and Cleaners of the United States and Canada, and the National Association Institute of Dyeing and Cleaning Inc., a school of dry cleaning and re-dyeing, which will be conducted more or less upon the correspondence system, at "Rock Crest," Silver Spring, Md.

In organizing the coures of study the following essentials have been kept in mind: Clearness and simplicity of presentation; Endeavor to hold the interest of the student; The study of trade processes, and a system of co-operation which will make it easy for the students to handle the comparatively short installments which are presented at any one time.

The course is intended to teach the student how to meet every situation that may arise in the carrying on of the dyeing and cleansing business. This work is in charge of Mr. C. C. Hubbard, assisted by an able corps of instructors.

W. H. & F. Jordan, Jr. Exhibit at Philadelphia

W. H. & F. Jordan, Jr. Manufacturing Company will occupy Booth No. 98 at the Knitting Arts Exhibition to be held in Philadelphia from May 12th to 16th. The display is designed to emphasize the advantages of their new product Seronex, and there will be numerous samples of fabrics, hosiery and yarns finished with this material. Another feature will be the showing for the first time of their new worsted lubricant Alubra.

International Nickel at the Knitting Arts Show

International Nickel Company, Inc., will have their exhibit in Booths Nos. 75-76-77 at the Knitting Arts where there will be shown Monel Metal and pure nickel in all commercial forms for the construction of textile machinery. Among the new products which will be exhibited will be found Monel Metal extractor baskets, Monel Metal reels for skein dyeing, Portable mixers for dyestuffs, sizes, etc., and Seamless Monel Metal dyehouses utensils.

Permutit at Philadelphia Exhibition

The Permutit Company, manufacturers of water softeners, filters, chemical feeds and other apparatus for removing impurities from water, will occupy Booths Nos. 101-102. They plan an interesting exhibit of full size industrial unit of chemical feeding equipment and in addition they will display a collection of photographs of typical installations and layout drawings from various types of plants where their apparatus is in use.

1930 Fall Woolen Colors

Advance swatches of the forty-eight colors which are to appear on the 1930 Fall Woolen Card have just been sent out to members of the Textile Color Card Association, according to an announcement by Margaret Hayden Rorke, Managing Director.

Browns are prominent in the group, tones of a ruddy mahogany hue being cited as especially significant. Rich coppery shades slightly rose in cast are also included. Browns with a rosy undertone and deeper tete de negre types are represented, as are also wood beiges.

Much importance is accorded the bluish reds, ranging from clear medium hues to deep rich wine tones. Greens fall into two groups, one bluish in cast, and the other slightly more yellowish in tone. In the blue family are two gammes. One ranges from an animated medium hue, to a clear deep marine, lacking the purplish cast. The other range of blues is more greyed or shadowed.

A special feature of the card will be a group of twelve lighter and more animated colors designated under the French caption of "Fillette," meaning "little girl." These shades, while especially suited to apparel for the young girl and junior miss, are by no means limited to these types. They are youthful colors smartly adapted to sportswear as well.

U. S. Pharmacopoeial Report

One of the features of the United States Pharmacopoeial Convention which is to be held in Washington, D. C., May 13 and 14, will be the Report on Color Names and the Color Exhibit supplementing this report.

The United States Pharmacopoeia is a legal standard for drugs and medicines and its revision is authorized at the beginning of each decunnun by a convention of physicians and pharmacists. In connection with the last revision it was noted that many color names were used in a haphazard way, and a study of color names and their standardization was undertaken. This report which covers eight years of investigation is to be given at this meeting. A summary of its various sections follows:

1. A general statement of the history of the work accomplished with certain recommendations.

2. A list of the 291 different color names used about 2400 times in the tenth revision of the U. S. Pharmacopoeia and a comparison of these with the color terms used consecutively 2400 times in Scott's Postage Stamp Catalogue.

3. A listing and discussion of the color names applied to 56 different gums and resins. The persons naming these colors included a music teacher with high education, an artist and three science teachers. The names they used indicate that even educated persons do not employ the same color names to designate identical colors.

4. A section devoted to the history of color charts and color systems.

5. A section devoted to the use of color names in science, art and commerce.

6. A section devoted to a description of optical and spectrophotometric apparatus used in analysing colors.

Dyers' Accounts, III

The Analysis of Purchases—Keeping Creditors' Accounts—Valuing Stocks

By S. HOWARD WITHEY, F.C.I.

TO ASCERTAIN the quantity and the value of the stock of dyes, chemicals, and other materials and stores on hand at any given time, it will be necessary to keep a stock ledger containing separate accounts of the stock grouped under suitable headings, the debit or left-hand side of each account showing the quantities received and taken into stock under that particular heading from time to time, and the credit side showing the quantities issued from stock, and the quantities, if any, returned to the suppliers. The balance of each stock ledger account should, of course, correspond with the actual stock on hand under that heading.

As far as the dyer's financial books are concerned, the purchases will consist of cash purchases and credit purchases, that is to say, while certain dyes, etc., will be paid for with cash on delivery, or cash with order, other dyes will be bought subject to payment some time in the future. Both these kinds of purchases transactions will fall under the same general heading or headings in the periodical final accounts of the proprietor, firm, or company, although the methods of booking the original items will be different. When a dyer buys materials or stores for which he pays immediate cash, a portion of the assets has been changed from cash to stock, and to be of any real practical utility the system of bookkeeping must make provision for this twofold aspect by causing a double-entry to be made, one entry having the effect of reducing the cash balance, and the other entry increasing the book value of the stock on hand. This essential double-entry may be effected by posting each payment transaction from the credit side of the general cash book to the debit side of the respective purchases or stock account, or as an alternative a cash purchases column may be ruled on the payments side of the cash book, and the monthly or other periodical totals of this column transferred to a general purchases account.

The dyer's credit purchases will have the effect of increasing the stock and also the sum owing to creditors and trade suppliers, and consequently the bookkeeping must be based on this fact by recording each item in a purchases book, or bought journal, and posting the amounts to the credit side of the particular personal accounts opened in the purchases or bought ledger. These purchases book entries should correspond with the details enumerated on the different invoices received by the dyer, and the precise ruling for the book will be governed largely by the size of the business and the class of trade. Some dyers will find a simple purchases book quite suitable, but the dyer who normally purchases a variety of dyes, etc., for different purposes will need an analytical book ruled in the manner indicated below.

If found to be more useful, in the case of a dyer dealing with many materials, for instance, the items could be classified under such headings as "Dyestuffs for Cotton," "Dyestuffs for Leather," "Dyestuffs for Rayon," etc., with an additional money column for recording capital outlay and expenditure, which has the effect of increasing either the number or the total value of the assets employed in the business for profit-earning purposes. In addition to columns for the systematic analysis of purchases transactions, some dyers will desire to classify the different management and working expenses as these are incurred or have accrued, and in such cases extra columns should be provided in the purchases book to correspond with the requirements of the dyer.

Each amount recorded in the "total" column should be posted to the credit side of the particular personal account, this purchases ledger entry giving the date of the invoice, the words "By Goods" or "By Dyes," and the page on which the transaction has been entered in the subsidiary book, after which the ledger folio should be inserted against the original entry to show at a glance that the amount has been properly dealt with in the dyer's books. Upon no consideration should a ledger folio be set down against any purchases book item until the amount has been actually posted to the ledger. When the simple form of purchases book is in use, the monthly totals should be transferred direct to the debit side of a general purchases account opened in the dyer's impersonal ledger, each such ledger entry giving the date, viz., the last day of the particular month; the words "To Sundries as per Purchases Book," and, of course, the folio, but if the purchases have been classified under two or more headings the monthly totals of the different columns should be transferred to the debit side of accounts bearing those names.

Dealing with Rejected Goods

Materials or stores which have been taken into stock but are subsequently discovered to be unacceptable for any

ANALYTICAL PURCHASE BOOK

Date	No.	Name	Details	Ledger Folio	Total	Bleaching and Preparatory Compounds	Dyestuffs	Chemicals	Finishing Mediums

good reason should be returned to the suppliers, and, providing the number of such transactions is really small, they may be entered at the end of the dyer's purchases book where a number of pages can usually be very conveniently reserved for this purpose. Each entry should show the date of rejection or return; the name and address of the suppliers; and the invoiced cost, and if no analysis is deemed necessary or desirable the monthly totals of this section should be transferred direct to the credit side of the general purchases account, the individual items making up each monthly total having already been posted to the debit side of the respective personal accounts. When the purchases are analyzed, the returns outwards should be classified under the same headings, the monthly totals of the different columns being deducted from the corresponding monthly totals of the purchases before the latter are transferred to the debit side of their impersonal accounts. Allowances made by creditors and suppliers in lieu of actual returns should be treated in the dyer's book in precisely the same manner as returns, and if the number of returns and allowances is at all considerable it will usually be found better to keep a separate purchases returns and allowances book, or credit book, in order to enable a suitable sub-division of the clerical work to be effected. Each entry should correspond with the particulars shown on the credit note received from the supplier or agent, and these credit notes should be numbered in strict consecutive order and passed through the books in that order. As soon as all the details have been carefully checked, the credit notes should be placed on a separate file in their correct order, and at the close of each month's work some dyers make a practice of removing the documents from the file and wrapping them up in a neat bundle which is then endorsed on the outside and placed on a shelf or in a drawer, leaving the file available for documents relating to the current month's transactions.

Although the guard book method of recording the purchases is not so common as it was a few years ago, some dyers still prefer to maintain this system in operation, especially if they are compelled to carry on with very little or no clerical assistance. This method consists of folding each invoice which has been passed, endorsing same with the name of the suppliers and the amount, then pasting the folded document in a large book made of cartridge paper down the right-hand side of which a money column is ruled for the insertion of the amount to be credited to each personal account kept in the ledger. The principal disadvantages associated with this method are that the bulky nature of the book makes it difficult to handle; that a systematic analysis of the transactions is not provided for; and, of course, the impossibility of allocating the work among different clerks or assistants.

* * *

The personal accounts of creditors and trade suppliers should be kept in a separate purchases ledger, never being opened in the same book as the accounts of customers and trade debtors. Whether this ledger shall consist of cards kept in a drawer, of loose leaves, or of a book of the ordinary ledger type, is a matter for the individual dyer to decide, but whichever method is adopted each account will have its debit and its credit side, and the principles governing the book-keeping will be identical.

Balancing Creditors' Accounts

To be in a position readily to ascertain the total sum owing to creditors, the accounts kept in the purchases ledger should be balanced and ruled off at the end of every month, the amounts outstanding being brought down, preferably in red ink, as the opening items for the next month. When balancing any account, the amounts appearing on the debit side should be added up, the addition checked, and the total inserted in pencil directly underneath the last debit entry. The amounts recorded on the credit side are also added up and this total inserted underneath the last credit entry. If the total of the credit items is greater than the total of the debits, the difference will represent the sum actually owing by the dyer to that particular person or firm, and this difference should be inserted as the last entry on the debit side of the account, with the date, viz.: the last day of the month, and the words "To balance carried down." The two sides of the account will then agree with each other, and the totals may be ruled off on the same line directly opposite each other, after which the balance should be brought down on the credit side, with the date and the words "By balance brought down."

Dealing with Invoices

In some instances, owing to over-payment on the part of the dyer, or to an insufficient deduction in respect of payment within a stipulated or recognized period, the total of the debit items may exceed the total of the credit items. To balance such an account, the difference between

the two totals would have to be inserted as the last entry on the credit side of the account, reading "By balance carried down," enabling the totals to be ruled off to correspond with each other and the balance to be brought down as the opening entry on the debit side for the following month, reading "To Balance brought down." As one of the objects of balancing the personal accounts is to avoid the constant adding of the same figures month after month, it is a good plan to rule off the totals of any account directly they are seen to agree with each other.

The dyer who purchases the greater part of his supplies from a few sources will find it both convenient and useful to pin together all invoices received from the same suppliers to await the arrival of the monthly statements of account. Subsequently, the details on both the invoices and the statements will be very carefully checked, compared, and ticked off, and a list of outstanding balances made out, the total of this list being recorded on the credit side of a "Sundry Creditors' Account." Upon remitting or paying cash or a check in settlement, or part settlement, of any of these accounts, the amount would be recorded on the payments side of the dyer's general cash book in the usual manner, and posted direct to the debit side of the "Sundry Creditors' Account," the balance of which will at any time, correspond with the total of the unpaid accounts on the file.

The Self-Balancing Principle

An important consideration at the end of the dyer's financial year is the speedy localization and detection of errors, and this can be greatly facilitated by keeping the purchases ledger on what is called the self-balancing principle. This principle is based upon the fact that apart from transactions of a special nature which would have to be provided for, all the items appearing on the credit side of the various personal accounts represent the invoiced cost price of dyes, materials, stores, etc., bought by the dyer on a credit basis, and that the items recorded on the debit side of the accounts represent cash paid, discounts obtained, and returns outwards and allowances. As the invoiced cost of all the credit purchases will be recorded and analyzed in the dyer's purchases book, and the cash paid and discounts obtained detailed in the cash book, and the returns and allowances entered either at the end of the purchases book or in a separate purchases returns book, it follows that the purchases ledger can be balanced independently of the other ledgers by collecting the totals of the books of original entry in the manner indicated below:

	£	s.	d.	£	s.	d.
Total credit balances outstanding at the commencement of the month, as per purchases ledger, after deducting the total of any debit balances	316	8	2			
Add						
Total purchases during the month, as per purchases book	198	5	6			
	514	13	8			
Less						
Total cash paid during month, as per cash book	150	17	5			
Total discounts obtained during month, as per cash book	5	18	9			
Total returns outwards and allowances, as per end section of purchases book	11	16	2	168	12	4
= Total credit balance outstanding at end of month				£346	1	4

Petty Cash

The various management and working expenses should be grouped under appropriate headings, all expenses of a similar nature being recorded in the same nominal account opened in the expenses or impersonal ledger. Payments made out of petty cash will be entered in the petty cash book and classified, and the most satisfactory system is that known as the "imprest" system, whereby a round sum is withdrawn from the bank to commence operations, this transaction being recorded in the bank column on the credit side of the general cash book and the amount posted to the debit side of the petty cash book. Each payment made out of petty cash during the month should be shown in a "total" column provided on the expenditure side of the book and extended, also, into its proper analytical column. At the end of the month the total expenditure will be ascertained by adding up the amounts shown in the "total" column, and the difference between this figure and the total on the debit side will represent the balance of petty cash in hand, and should agree with the actual contents of the register, till, or cash box.

Analytical Column

Before inserting the balance and ruling off the monthly totals, another check should be withdrawn on the banking account, this amount corresponding with the total expenditure during the month to be posted from the general cash book to the debit side of the petty cash book, thereby showing the original round sum to be still in hand or "imprest." Instead of transferring the monthly total of the expenditure to the debit side of the sundries account, or trade expenses account, it is much better to transfer the totals of the various classification columns to the debit side of specific nominal accounts. In this connection a good check on the accuracy of the entries is afforded at the end of each month, and indeed at the foot of each completed page, by seeing that the totals of the analytical columns, when they are added together, exactly agree with the figure shown in the "total" column. Below is a good general ruling for the dyer's petty cash book.

The number of analytical columns, and also the headings, will vary in individual cases, and speaking generally it may be said that the greater the degree of analysis, the more useful will be the figures incorporated in the final accounts.

Dr. Cr. PETTY CASH BOOK

Date	Received	Folio		Date	Paid	Total	Carriage and Cartage	Stamps and Postages	Purchases	Sundry Trade Expenses	Ledger Accounts		
											Name	Ledger Folio	Amount

* * *

Before the dyer can ascertain the financial result of his accounting period he must value the stock of dyes, chemicals, and other materials on hand at the balancing date, and although all stocktaking operations are inevitably somewhat arduous it is possible to facilitate the work by apportioning it in a systematic manner.

It is a good plan to instruct one or more persons to call out the quantities and descriptions of the stock in each workshop or store, and to arrange for others to set down these particulars on suitably ruled sheets. Generally, it will not be necessary to classify the items under different headings, although a distinction must naturally be made between finished goods, partly finished work and unused dyes, etc. Two money columns ruled on the stock sheets will usually suffice. If, however, an analysis of the stock is required, then of course, several money columns must be provided to enable each item to be inserted under its most appropriate heading. It is even better to have each class on a separate sheet.

When entering the details on the sheets care should be exercised to ensure that nothing of the following nature is included:

1. Any assets such as indicators, regulators, machinery, fixtures, furniture, etc., the value of which is already shown in separate accounts kept in the dyer's private or impersonal ledger. The effect of taking such goods or assets into stock would be to inflate the profit side of the trading account and to place an excessive value on the assets as shown on the balance sheet.

2. Any dyes, or other products, which have been received from suppliers prior to the date of stocktaking, and the value of which has not been included among the periodical purchases. Here, again, the effect would be to inflate profits.

3. Any work which is completed and has been recorded in the dyer's sales book or day book on or before the balancing date, but which for some reason has not yet left the premises. Nothing which has been entered in the books as a sale can be correctly treated as stock.

The customary basis of stock valuation is the cost price of the dyes, other materials, dyework in progress, etc., but it should never be forgotten that in those instances where the prevailing market price of any stock has dropped below the actual cost, the items should be valued at the current price level. If, however, prices have risen, it is always safer to assess the stock at actual cost. All soiled or damaged materials should be shown at their estimated value, or at cost price, whichever happens to be the lower, but old or badly damaged stock that has become quite useless, or left unpriced, should be ignored.

The pricing out of the items on the sheets should be done either by the manager of the buying department or by the order clerk, and in all cases the calculations, extensions, and additions should be carefully checked by clerks who have not actually made the calculations, etc. The work performed by each person should be separately signed for, the completed sheets as a whole being signed by the dyer, the secretary, or other responsible official. Examples of these detailed certificates are given below:

1.

"I hereby certify that the stock of dyes and other materials and stores on hand at December 31, 1929, was taken and classified by me, and called out to William Sharp by whom the details were recorded on the stock sheets.

(Signed) NORMAN BISHOP,
Foreman Dyer to Messrs. J. W. Bell & Co.
Worcester,
14*th January*, 1930."

2.

"I hereby certify that the stock of dyes and other materials and stores on hand at December 31, 1929, as taken and classified by Norman Bishop, was correctly set down by me on the stock sheets.

(Signed) WILLIAM SHARP,
Assistant."

3.

The total value of the stock should be certified by the manager, or the directors, as the case may be, a good form of certificate being as under:

"1 (or we) hereby certify that the stock on hand and the work in progress of (name of firm) at December 31, 1929, set forth above, amounting to—pounds—shillings or—pence (£ s. d.) is valued at prices not exceeding

Dr. STOCK ACCOUNT *Cr.*

1928		£	s.	d.	1929		£	s.	d.
Dec. 31	To Stock	1,597	18	2	Jan. 1	By Transfer to Trading A/c	1,597	18	2
1929									
Dec. 31	To Stock	1,726	15	9					

cost and was available for the purposes of the Company's business on that date.

(Signed) J. W. BELL,
or (Signed) J. W. Bell, C. J. Bell } *Partners.*

or (Signed) WORCESTER DYEWORKS,
or (Signed) WORCESTER DYEWORKS, LTD.,
J. W. Bell, C. J. Bell } *Directors.*

To cover discounts allowed by suppliers on the invoiced prices of certain materials, a percentage deduction may be made from the particular items on the stock sheets.

Although the value of the stock at the close of the financial period will be in the nature of an adjustment entry, brought into the trading account for the purpose of ascertaining the balance of profit realized, the figure will not be needed to balance the set of books and to prove the clerical accuracy of the book-keeping work. The amount should, therefore, not be entered in the books until the final accounts have been drafted, the closing stock being then set down on the credit side of the trading or profit and loss account and recorded also on the debit side of the stock account kept in the private ledger. The value of the stock at the close of the previous accounting period will have to be transferred from the stock account to the debit side of the trading account. A specimen stock account is shown above.

When preparing the balance sheet at the end of 1929, the balance of the stock account, namely, £1,726 15s. 9d. would have to be included on the assets side, under the heading of "Stock and Work in Progress, at cost."

—*The Dyer & Calico Printer.*

(*To be continued*)

Ciba Color Card

Ciba Company, Inc., has recently distributed color card No. 711 of the Society of Chemical Industries in Basle, dyeing on rain coat material. This exhibits current shades on such material obtained in both Chlorantine fast dyes and Pyrogene Vat Dyes.

Chlorantine fast dyes have been taken into consideration first because of their fastness to light and to washing. After-treatment of the Pyrogene dyestuffs bichrome, sulphate of copper and acetic acid has been avoided, with regard to probably after-impregnation with rubber and vulcanization. For the same reason those shades included in the card are grouped in copper-containing and copper-free dyestuffs.

General Dyestuff Releases

The General Dyestuff Corporation have recently sent out circulars illustrating their Celliton Yellow 5G Pdr., the imported brand which is suitable for dyeing and printing acetate silk. According to the announcement it is of an extremely greenish, pure yellow shade of good to very good fastness properties and is particularly recommended for the production of bright green shades, in combination with Celliton Fast Blue Green B.

The same company have also given to the trade a new card entitled "Supramine and Radio Colors on Woolen Yarn," which shows an extensive line of fancy shades produced with this class of acid dyeing colors. It is stated that Supramine resp. Radio Colors from a Glauber's Salt Sulphuric Acid bath produce level dyeings of very good fastness to light, washing and perspiration, thus especially adapted for the dyeing of knitting yarns, hosiery, sweaters and bathing suits.

As sole importers of the dyestuffs manufactured by the I. G., General have offered Indanthrene Olive Green B Powder Fine which they claim to produce full green shades of excellent fastness to light and weather, washing, chlorine and peroxide bleach.

General Dyestuff have likewise announced, in their capacity as selling agents for the General Aniline Works, two products, Zambesi Black VA and Brilliant Milling Red RA, the former corresponds to the imported Agfa Zambesi Black V which is recommended for union dyeing half-silk hosiery. The latter is suggested for producing bright red shades on loose wool and shoddy.

Recent Literature

Dry Cleaning and Re-Dyeing Handbook. C. C. Hubbard, formerly Director of Research and Education for the National Association of Dyers and Cleaners of the United States and Canada, and the National Association Institute of Dyeing and Cleaning Inc. Associate editors, Edwin R. Donaldson, Mable Fading. Rock Crest, Silver Spring, Maryland. 1929. *Price* $5.00. *252 Pages.*

This book has been published to satisfy the insistent demand from those interested in dry cleaning and re-dyeing for a practical handbook which covers the whole subject in a condensed way and does not necessitate going into the minute detail which is required for instructional and text book purposes. With this in mind the authors have produced a very creditable and very valuable reference handbook. It is excellently adapted not only to the experienced practical work, but to the apprentice and the student. It is divided into ten specific sections as follows:

1. Dry Cleaning Practice.
2. Stain Removal.
3. Wet Cleaning Practice.
4. Bleaching and Stripping.
5. Dyestuff Application.
6. Finishes.
7. Tests.
8. Tables.
9. Definitions.
10. Miscellaneous useful information.

While the book is primarily intended for a handy reference book, in addition it furnishes a very excellent outline for the study of the whole subject of dry cleaning and re-dyeing, and many subjects are taken up with sufficient detail to serve as a text for students.

"Fast Dyeing and Dyes"—James Morton. A history of the development of fast dyeing and dyes presetned before the Royal Society of Arts, February 20th, 1929 *and since published in book form by Scottish Dyes Ltd., Grangemouth, Scotland. 62 Pages.*

This book will furnish very interesting and instructive reading to all who are interested in the dyeing industry, and particularly to those who were connected in any way with the struggle which the dyeing industry went through during the period of the World War in attempting to carry on and maintain the essentials of the coloring end of the textile industry in America.

The author describes in a very entertaining way the search which he conducted first, in ascertaining just what dyes and dye combinations could be satisfactorily used to produce light fast tapestries, and then the still greater task of manufacturing these dyes in the face of what appeared to be numerous insurmountable obstacles. He comments on several trips made to America during this period and the important part which America took in co-operating with him in his extensive undertaking, particularly in connection with certain vat dyes. In a period of four years or less, a completely new dyestuff industry including chemical staff, equipment, and processes was developed by a textile manufacturing organization, and before the war was over, this particular textile manufacturing concern was not only making many of the dyes which it could not procure elsewhere, but was furnishing a considerable quantity to other textile manufacturers.

"Annual Survey of American Chemistry Vol. IV" by C. J. West and Associates, prepared under the auspices of the Division of Chemistry and Chemical Technology of the National Research Council, published for them by the Chemical Catalog Company, Inc., 419 *Fourth Avenue, New York. Pages* 550. *Price* $4.00.

With the publication of this the fourth volume of the Annual Survey of American Chemistry we have a review of the progress made in all branches of chemistry of America during a period of eighteen months from July 1, 1928 to December 31, 1929.

The object of this survey is to bring together throughout a period of years a complete review of American chemistry. In this particular volume there are 43 chapters each devoted to a specific phase of pure or applied chemistry.

While the book is devoted fundamentally to progress made in the field of American chemistry, it should be noted that progress in chemistry cannot be confined by the boundaries of any one nation, and as a result, chemical progress abroad is soon reflected in work that may be carried on in America.

From year to year in this series different subjects may be emphasized and others entirely omitted, depending upon the amount of work which may have been published in these particular fields during the previous year. New authors are also selected from time to time in order that there may be a varied point of view in the subject matter presented.

Readers of the *American Dyestuff Reporter* will be particularly interested in:

Chapter 35, Cellulose and Paper, Louis E. Wise and Floyd C. Peterson, of the Department of Forest Chemistry, New York State College of Forestry.

Chapter 36, Rayon, G. P. Hoff, of the Du Pont Rayon Co., Buffalo, N. Y.

Chapter 38, Azo Dyes, M. L. Crossley of the Calco Chemical Co.

Chapter 39, Anthraquinone Dyes and Intermediates by Robert J. Goodrich, Chief Chemist, Anthraquinone Vat Dyes. The Newport Company.

Chapter 42, Solvents and Lacquers, V. C. Bidlack, Chief Chemist, O'Brien Varnish Company.

The special chapters on Solutions, Colloid Chemistry, Water, Sewage and Coal will also be of interest to many textile chemists.

L. A. O.

Technical Notes from Foreign Sources

Distinguishing Between Viscose and Cupro-Silk

Dipl.-Ing. Rudolf Geier—Monatsch. f. Textil-Ind. 45, 30 (1930).—Much has appeared in the literature regarding ways of distinguishing between viscose and cupro-silk. O. Faust, in his work "Artificial Silk" (1928), gives some methods, among others that involving those dyestuffs which, according to A. Lehne, provide a means of distinction between the two kinds of silk, depending upon the strength of the dyeings; and only recently certain Neolane dyestuffs have been cited as suitable for the same purpose by W. Dischreit (Kunst-Seide, March, 1929). More used than these methods is that of Zart, which consists in the dyeing of the two kinds of fiber in a mixture of "Pelican Ink No. 4001" and Eosine, and which has been proposed by the A. W. T. (or R. A. L., the Reichsausschuss fuer Lieferbedingungen") as a standard method. But all of these dyestuffs are merely a selection from the most different ones which we have available, while the large series of the direct dyestuffs, which are very suitable for the purpose, are never mentioned. This may be due to the fact that the direct dyestuffs are always dyed at a temperature as high as possible, to obtain good levelling, and under those circumstances the striking difference in the dyeings from the two kinds of fiber is less evident. The "Temperature-Series Experiments" of Whitaker (J. Text. Inst. 18, 1928) formed the first announcement that there are only few direct dyestuffs which show maximum dyeing-power at 20°, and that most show this maximum at 50°-60°, or at 90°. In an extensive study of the dyeing of artificial silks (the author's Dissertation, presented to the Saxon Technical High School, Dresden, 1929) in which special attention was paid to the Sirius dyestuffs produced by the I.G., the author found, in this series of direct colors, that at 20° viscose of all kinds was most weakly dyed, while at the same temperature cupro-silk was very strongly dyed. Further experiments have shown that any of the Sirius colors can be used to show this distinction, merely by dyeing, with the addition of Glauber's salt, at 20° C., for two minutes. Viscose, at best, dyes very weakly; cupro-silk very deeply. Naturally, the dyestuffs most suitable are those which dye most deeply at 90°. In the dissertation mentioned there is a table of the maximum dyeing-temperature of the Sirius colors.

The fact that the absorptive power of viscose becomes greater through pre-treatment, especially with caustic, has given rise to the suspicion that in case of such pre-treatment the differentiation between the two kinds of silk would not be so decisive. This suspicion has been proved to be groundless. Pre-treated viscose does dye up somewhat more strongly in the short dyeing than does the untreated fiber, but requires a higher temperature than the one noted, to become dyed as deeply as the cupro-silk.

The difference in the dyeings can be made more evident by scientific methods of measurement, as the determination of the color-tone, the white-content, the comparative brilliancy, and the dyeing-power, by the Step-photometer of Klughardt, for example. A table is given, for six Sirius colors, on the two fibers, showing the values for color-tone, white-content, comparative brilliancy, and full-dyeing values.

Use of Carbohydrates in Spinning of Cupro-Silk

Dr. K. Melkus—Kunst-Seide 11, 446 (1928).—As soon as the great technical importance of the solutions of cellulose in copper-oxide-ammonia had been recognized, attempts were made to increase the stability of such solutions, which under ordinary conditions are unfortunately none too stable, by addition of various substances. Those proposed, and also used with good results, are very numerous; most of them are such as are able to hinder the harmful oxidation of the cellulose and the copper salt, being of reducing nature. Of such substances, among others, the carbohydrates have been shown to be especially suitable.

As early as in German Patent No. 228,872 (1908), the use of carbohydrates for this purpose was proposed, and in this patent the addition of the carbohydrate was made only after the mixing of the cellulose with the copper-oxide-ammonia solution (or the "cupro-cellulose" with the ammonia)—a method which, however, proved to be impracticable on the large scale. Accordingly, in the addition-patent No. 241,921 (1909), it was recommended to add the cellulose or the copper-oxide-ammonia solution (or also the precipitated copper hydroxide) to the organic substances which were to increase the stability of the mixture, before the product was worked up so that these stabilizing substances would be present in the mixture at the time when the solvent action began. Only in this way could those properties of the carbohydrates, which favor the solvent action, become fully active, and a uniform action upon the whole spinning-process be reached.

The question may now be asked, which of the numerous carbohydrates can exert upon the properties of the spinning-solutions that action which is most favorable for its later practical working-up into artificial silk? It is true that an increase in the stability of the cellulose-copper-oxide-ammonia solutions can be reached in a greater or less degree by any of the known carbohydrates, but the influence of the different members of this class of substances, especially upon the spinning-properties of the solution, as well as upon the properties of the fibers produced from them, is very variable, and in part very un-

favorable, so that a proper choice among these substances is of an importance not to be under-estimated. It would seem of interest to review briefly the facts discovered in this connection, through work with the different sugars.

In the patent already mentioned (No. 228,872), hexoses and hexobioses, as well as polysaccharides, were recommended as additions to the copper-oxide-ammonia-cellulose mixture; to be precise, the considerable amount of 25% of the weight of the cellulose was added (as example, an addition of 35% potato-syrup was mentioned); these quantities were probably based upon experiments which were carried out with the help of sugars of only weak reducing power, namely, polysaccharides or cane sugar, which were apparently regarded as most suitable for the purpose in hand. Only upon the basis of longer experience and closer study of the chemical process, to which the action of the carbohydrates upon the copper-oxide-ammonia-cellulose solution is to be ascribed, were we able to reach the conclusion that the weakly-reducing sugars were least suitable for the purpose. For it became evident that, for the obtaining of a sufficiently high degree of stability of the spinning-solution, the addition of such great quantities was necessary, that the properties of the fibers spun from such solutions were strongly affected in luster and strength, and that, further, during the spinning of solutions so prepared, on account of the high content in slimy substances, blocking up of the fine spinnerets too easily took place.

The expected favorable influence of such carbohydrates upon the spinning-properties of the solutions, as well as upon the physical properties of the fibers obtained from them, was therefore not gained. It was correctly pointed out, in German Patent No. 306,107 (1917), that it is not requisite to add carbohydrates in large quantity to the spinning-solution (as would follow from German Patent No. 228,872), and that these substances should not compose a physical element in the fiber at all, but should exert only an essentially chemical influence upon the spinning-solution. This action should consist first of all in the retarding of oxidation of the copper salt and the cell-substance, whereby the dissolving of the cellulose should take place more rapidly and completely, and the solution should become more stable. This end is best reached by use of such sugars as exert a strong reducing action even at a low concentration, and at the ordinary temperature, namely, the monosaccharides. An addition of ¼% on the cellulose-content, of one of these sugars, is sufficient for the attaining of the desired stability of the spinning-solution, so that, accordingly, the above-mentioned disadvantage, that resulting from the addition of too great quantities of sugar when polysaccharides or cane sugar are used, will be entirely obviated. In any case, however, a disadvantage of another sort comes to light, in reference to the spinning-properties of the solution, since the monosaccharides exert a dehydrating influence upon the cellulose, so that, as a result, the cell-substance does not ultimately contain sufficient water chemically combined, to be precipitated in the spinning-bath as cellulose hydrate of full value; only in the latter form, however, does the spun fiber possess its desired properties of luster, strength, and elasticity. To avoid this disadvantage it is proposed in the patent mentioned above (No. 306,107) to add to the solution, beside a monosaccharide, a second kind of sugar, a member of the disaccharide group; the sugars of this group possess the property of exerting a hydrating action upon cellulose, and so of reforming the fully hydrated cellulose-fiber, so exerting a favorable influence upon the spinning properties of the solution. As this second carbohydrate, cane sugar is particularly recommended, as a weakly reducing disaccharide, which in this case has to exert only a hydrating influence, while the monosaccharide also present serves to retard the oxidation of the spinning-solution, and so to act only as a stabilizer. The spinning-solutions so prepared gave results which were very good, as was expected.

In considering the results thus briefly reviewed, one question may be raised: whether it might be possible to gain this increase in the stability of the cupro-solution, together with the improvement in its spinning-properties, (as is accomplished in the way described, by addition of two different carbohydrates), by the use of some single carbohydrate. Experiments carried out with this question in mind have shown that this is possible only if such a carbohydrate is used as unites in itself these favorable properties; this is the case only with those carbohydrates of the disaccharide group which, as a result of the presence in the molecule of a free carbonyl group, show as great reducing power as the monosaccharides, that is, lactose and maltose. These sugars possess sufficient reducing power toward the copper salt and the cell-substance, and also a favorable hydrating influence upon the cellulose, and, in fact, as experiments have shown, contribute to an essential increase in stability of the spinning-solution, as well as improvement in the spinning-qualities. The solutions, prepared with addition of either of these carbohydrates, show almost unlimited stability when kept in storage, if stored in closed vessels; they endure higher temperature without harm, and are specially noteworthy for displaying great "spinnability" (Ausziehbarkeit), so that they are highly suitable for the production of the finest fibers by the tension-spinning process. Furthermore, these two carbohydrates appear to influence favorably the dissolving of the cellulose; for from unbleached and undisintegrated cotton linters a 10% completely homogeneous spinning-solution of excellent spinning-properties could be produced through addition of either of these two sugars, while the same raw material, by addition of any other sugar instead, under the same conditions, could not be completely dissolved. The carbohydrate was, in these experiments, sometimes added directly to the precipitated copper hydroxide, and this, after mixing with the cotton linters, dissolved in the ammonia.

It may therefore be stated, on experimental grounds, that these two sugars, lactose and maltose, have been shown to be the most suitable carbohydrates for addition to the spinning-solution, and that the use of them for the

preparation of stable cupro-spinning solutions is of great advantage, especially in cases where a particularly fine fiber is to be produced.

The General Chemical Company have opened a warehouse at 201 West First Street, Charlotte, N. C., effective May 1, 1930. James J. Peyton will be the resident salesman in charge.

D. M. Bailey, who has been with the Riverside and Dan River Mills, Danville, Va., is now in charge of dyeing at the Durham Cotton Manufacturing Company, Durham, N. C.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, OF AMERICAN DYESTUFF REPORTER, published bi-weekly at New York, N. Y., for April 1, 1930.

State of New York, County of New York, s. s.:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. S. Predmore, who, having been duly sworn according to law, deposes and says that he is the business manager of the AMERICAN DYESTUFF REPORTER, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

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E. S. PREDMORE, Business Manager

Sworn to and subscribed before me this 25th day of March, 1930.
(SEAL) CAROLINE ESSENBREIS

(My commission expires March 30, 1931.)